ELECTRICAL REVIEW

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Physical Instrumentation

THE five-day display of measuring instruments and allied equipment as well as research apparatus in London this week-end is the thirty-sixth of the series of exhibitions organized annually by the Physical Society. It has again this year had to be accommodated in two separate buildings in South Kensington, which is a pity. Although an endeavour has been made to present so far as is possible a representative selection of apparatus in each portion of the show, this arrangement can be inconvenient in some respects and is not universally liked.

The annual attendance leaves no room for doubt, however, about the general popularity of this exhibition, which reflects the vitality of the instrument making industry in Britain and strikingly demonstrates its versatility. Ingenuity as well as resourcefulness are now needed to " engineer " measurement and devise control circuitry for satisfying individual requirements in many branches of industry that are being guided towards " flow line " processing for speedy quantity production. Indeed electrical instruments which are simple indicators and recorders are no longer having the individual attention they formerly received; they have rather come to be accepted simply as component parts of a " set-up " which the designer incorporates to reveal the results of certain operations or to check at various stages the performance of the complete apparatus.

This exhibition thus represents, more than any other, the latest trends and practices in instrument design and manufacture. Another purpose, which has always been the aim of its promoters, and one that it fulfils admirably, is to give, once a year, an opportunity to makers of instruments to discuss technical features of their products with physicists, both academic and industrial.

The definition of the term physicist, incidentally, is being much more loosely interpreted than it was originally. It is now tending to be used to denote anyone who is engaged on research into, or the development of, instrumentation as distinct from instruments

themselves. Much fresh equipment has been designed for both pure and applied research laboratories. Nine Ministry of Supply and other Government establishments are represented in the exhibition while rearmament has caused a resurgence of demand for equipment for the Services, apart from that for aids to still greater productivity for maintaining the volume of exported goods. Thus recognition of the value of British science as a national asset is happily growing; the scope of the exhibition has been very much enlarged with the passage of time, while the understanding that any one instrument may not be displayed more than three times is intended to help to preserve the original and unique character of this exhibition—which is not a trade show.

HYDRO-ALTERNATORS

Although high-speed generators for water-power plants of the large capacities covered by the I.E.E. Supply Section paper of Messrs. E. M. Johnson and C. P. Holder (reviewed in this issue) are most unlikely to be installed in this country, they are nevertheless being built here for the increasing number of high- and medium-head stations abroad, especially in South America and Canada. The chief technical interest lies in the methods adopted in the design and construction of the rotor and its components, the first critical speed of which, unlike that of steam turbines, must exceed the runaway speed.

PRICE AND QUALITY

Trade associations are widely thought merely to be "rings" for maintaining prices against the public interest. As Sir Ronald Matthews pointed out at last week's annual luncheon of the Electric Light Fittings Association, they are more than that. They certainly do endeavour to maintain fair prices and may thus be said to eliminate price competition. But their members are still competitors and each continually strives to offer better products or better service than the others. In this way the public is benefited and the industry or trade is improved while being protected from the chaos resulting from cut-throat price competition.

NEW LAMPS

Brief particulars are given in this issue of two new departures by members of the Electric Lamp Manufacturers' Association. The first, a 40 W circular fluorescent lamp, is not novel, except in the design of the cap, for circular fluorescents are already available. The other is the pouring of a pint and a half into a pint pot: in other words the enveloping of a 60 W filament lamp in a 40 W bulb. This arrangement will save glass and (more important perhaps) packing and space. From the customer's point of view it will be useful as a substitute for the 40 W lamp in fittings which will not take a larger bulb and consequently give inadequate illumination.

UGANDA'S FUTURE

According to a contributor to *African World*, Uganda is by far the most prosperous of the East African territories. It exported nearly twice as much as it imported in 1950 and in the first eight months of last year exports and imports were valued at £23 million and £14 million, respectively. Under a comprehensive development plan an expenditure of some £63 million is contemplated in the ten years 1947–1956. One of the most important schemes is the building of a dam and hydro-electric plant on the Nile near Jinja, to undertake which the Uganda Electricity Board was set up in 1948. Its fourth report, summarized in this issue, records good progress with the work and within two or three years power should be available from Owen Falls to attract new industries to the country as well as encouraging the expansion of those already existing.

Scientific Instruments

Survey of the Physical Society Exhibition

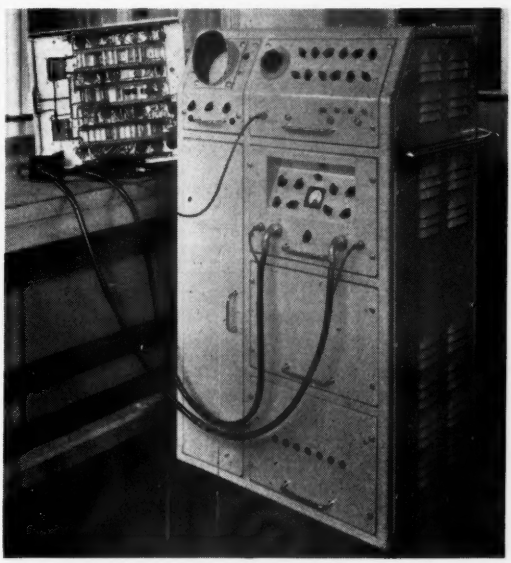
THE thirty-sixth annual exhibition of scientific instruments and associated apparatus to be organized by the Physical Society was opened yesterday (3rd April) at the Imperial College, Imperial Institute Road, and the Huxley Building, Exhibition Road, South Kensington, London. It will remain open, with the exception of Sunday, until Tuesday next, 8th April.

As is well known, the primary purpose of these exhibitions is to indicate advances in design and without a doubt this year's display illustrates the outstanding vitality of the British scientific instrument industry. The variety and width of range of products shown by manufacturers, together with the demonstrations by research organizations and the universities, illustrate the rapidly increasing application of physical principles to the needs of industry.

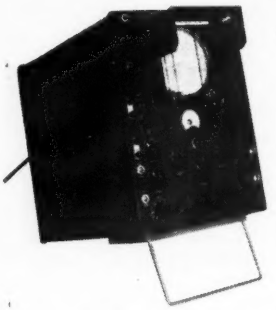
As is the custom, two discourses will be delivered in the large chemistry theatre during the period of the exhibition. At 6.45 p.m. this evening Mr. B. N. Wallis (Vickers Armstrongs, Ltd.) will speak on engineering supersonic aerodynamics while on Monday evening Mr. E. R. Davies (Kodak, Ltd.) will deal with the physical basis of colour photography. The prize-giving in connection with the annual Craftsmanship and Draughtsmanship Competition will take place to-morrow (Saturday), the entries being on show on the first and second floors of the College.

Of course, there are a large number of oscillographs on view, many of them for special purposes; among the latter J. Langham Thompson show a seven-channel instrument for the photographic recording and simultaneous visual monitoring of waveforms. It incorporates seven pairs of 1·5in cathode ray tubes having an individual time base and X and Y amplifiers, the time base for the monitor tubes being so arranged that two complete repetitions of a waveform are always displayed although the frequency and amplitude may be varying.

Apart from a general display of components, ancillary apparatus and models relating to particle accelerator installations, the Metropolitan-Vickers Electrical Co., Ltd., has a high speed waveform monitor which displays on a cathode ray tube a recurrent waveform having frequency components as high as 300 Mc/s and, if necessary, of less than 0·1 V amplitude. There is also a quick convergence computer for four simultaneous equations on which the four errors are simultaneously displayed, thus

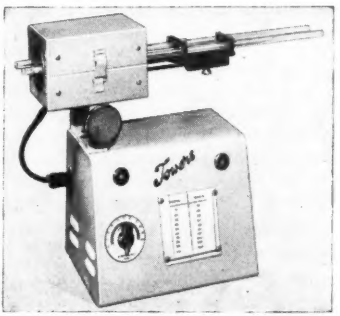


Metrovick recurrent waveform monitor



Standard Telephones engine indicator

J. W. Towers precision heating block



facilitating the solution of ill-conditioned matrices.

The high quality general purpose oscilloscope of Philips Electrical, Ltd., is supplemented by precision signal generators, special purpose d.c. l.f. and h.f. millivoltmeters, and a high powered stroboscope with a flash frequency of 0·5–250 c/s. The light intensity is adjustable to 20 × 10^6 lumens and the flash duration is 3 sec. The universal oscilloscope of Southern Instruments, Ltd., is capable of making an extremely wide variety of measurements. It comprises essentially an oscilloscope containing a 5in cathode ray tube with d.c. X and Y driver amplifiers and a time base. To this can be added external amplifiers and other units to extend its performance and utility.

Other oscilloscopes and specialized electronic apparatus are shown by A. E. Cawkell, Solartron Laboratory Instruments, Ltd., Inter Electron Industries, Ltd., and Allied Electronics, Ltd. Oscilloscopes are also demonstrated by Nagard, Ltd., together with d.c. amplifiers in which a crystal rectifier network is employed to introduce the carrier frequency in place of the balanced convertor valves previously employed. This results in a reduction of both inherent noise and hum, while allowing a simpler system of stabilization to be employed.

The B.T.H. exhibit demonstrates the higher efficiency and greater power handling capacity of germanium, now processed to produce an internal large area barrier (p-n junction) instead of the surface wire contact hitherto used. Other features on the stand include a demonstration of electroluminescence and of a 0·25 h.p. squirrel cage motor running under water. Complete sealing of the windings has been achieved by insulating the stator with a modified polyster resin which can be used either for casting or impregnating.

Naturally the Westinghouse Brake & Signal Co., Ltd., is showing rectifiers and here again there are germanium crystal types. There is also a demonstration of a new system of regulating the output voltage or current of metal rectifiers known as the "Transbooster." This enables the size, weight, cost and excitation power of the transductors to be reduced to about a third of the former values.

Germanium crystal diodes are displayed by Standard Telephones & Cables, Ltd., together with a crystal triode amplifier. Also on view are asymmetric resistances, known as "Unistors," and an engine indicator which has been developed in conjunction with the Anglo-Iranian Oil Co., Ltd. It operates from a 12 V battery and is used for measuring cylinder and fuel line pressures, torsional vibration and other similar phenomena, a visual display being given on a cathode ray tube.

To replace the usual dual process of sputtering an initial conducting film with subsequent electroplating for frequency adjustments to quartz crystals, W. Edwards & Co. (London), Ltd., have produced a new type of vacuum coating apparatus to complete the process in one cycle. Sixteen crystals mounted on a turret head can be coated on one side in a single evaporation from one source. The remaining face of each crystal is then coated as required individually. While coating in this manner

the frequency can be measured, connection being provided for an external oscillator.

A single crystal germanium ingot and a single hexagonal crystal are shown on the joint stand of Marconi's Wireless Telegraph Co., Ltd., and Marconi Instruments, Ltd., together with a double selectivity "Q" band wavemeter and demonstrations of phase contrast resolution in radar, and Rayleigh range transmission of power with small loss.

Electroluminescence is also demonstrated and germanium crystals are shown by the General Electric Co., Ltd. Furthermore, there is a measuring bench equipped with a range of instruments such as are used for the development of wideband v.h.f. trunk radio systems, and a high temperature vacuum furnace. This furnace, which employs a graphite element and holds a cylindrical charge about 6 cm long and 3 cm in diameter, is mounted directly on a 300 litre/sec pump. Heat conservation is achieved by radiation screens and, because of the low thermal capacity, a temperature of 2,000 deg C can be reached in a few minutes.

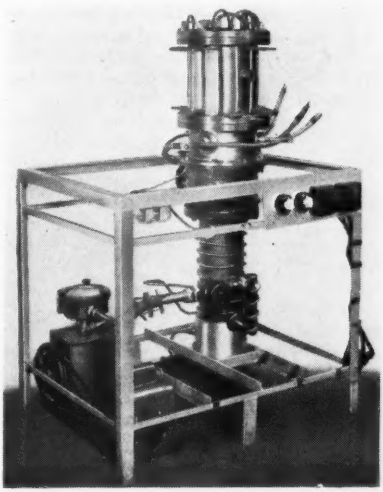
Salford Electrical Instruments, Ltd., have fluorescent lamp ballasts in the form of iron powder toroids which are available for primary supply frequencies of 400 and 850 c/s and associated lamp wattages from 10 to 50 W. There is also a quartz crystal activity test set for measuring directly the equivalent parallel resistance at input circuit capacities of 20, 30 or 50 pF. The accuracy is ± 5 per cent for crystals of 2 to 10 Mc/s, the accuracy for crystals between 1 Mc/s and 20 Mc/s being slightly lower. In an allied field Evans Electroselenium, Ltd., have a single photocell flame photometer, with which results are reproducible within ± 1 per cent, and a direct reading colour temperature meter for the easy and speedy determination of natural and studio lighting.

Colour temperature and light meters are exhibited by Megatron, Ltd., while Siemens Research Laboratories have a new brightness photometer the principle of which consists in viewing simultaneously, by means of a Lummer-Brodhun prism, the surface under test and a surface illuminated to a known value; the intensity of illumination of the standard or known surface can be varied and made to appear equal to that of the test surface. There is also a new source of ultra-violet continuum and a spectral band photometer and colorimeter.

The Baird & Tatlock infra-red heating unit has been designed as a source of heat for evaporation and crystallizing, but can be used for many other purposes. It comprises a 250 V infra-red lamp with internal reflector and rotary rheostat for controlling the intensity of radiation, both enclosed in a cream stove-enamelled casing. Another interesting piece of heating apparatus is the precision heating block shown by J. W. Towers & Co., Ltd., which is for purifying micro quantities of a wide range of substances. The heating block is made of aluminium and has a small cartridge type heating element operating at 50 V. The heating range is 50–250 deg C and any temperature in this range can be maintained within ± 2 deg C.

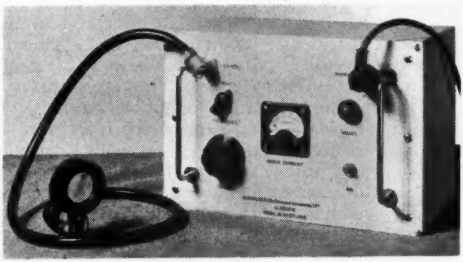
Among laboratory ovens, thermostat baths, etc., Townson & Mercer, Ltd., include the "All Clear" precision thermostat bath which incorporates a new patented all-mercury control system with infra-red heat feedback and a brushless immersion circulating pump. It gives control accuracies within $\pm 0{\cdot}01$ deg C at relatively low temperatures and will work with oil or water including circulating these through external apparatus. Laboratory ovens and furnaces are also shown by A.E.W., Ltd.

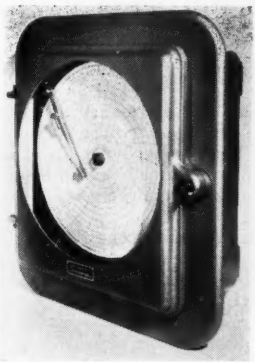
G.E.C. high temperature vacuum furnace



Right: **Fielden "Servograph" recorder**

Below: **Nicolson ultrasonic generator**





The thermostatic water bath of A. Gallenkamp & Co., Ltd., covers a variety of laboratory applications with a temperature range to 100 deg C. It is heated uniformly by a tubular immersion heater and controlled to within $\pm 0{\cdot}5$ deg C by a bimetallic thermostat and hot-wire vacuum switch. Electrothermal Engineering, Ltd., shows a number of bi-metal thermostats with and without quick-make-and-break contacts and two interesting types of flexible heaters. In one, flexible flat heating elements are embedded in sheets of heat resisting rubber, which can be supplied up to 6ft wide for temperatures up to 200 deg C. The others are glass insulated tapes which are available in many lengths with surface loadings up to 2 W/cm² and temperatures up to 550 deg C.

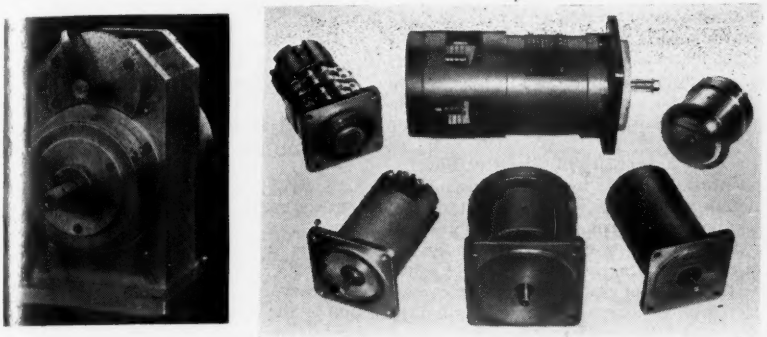
The heat control devices shown by Sunvic Controls, Ltd., include a resistance thermometer controller which, with a suitable platinum resistance thermometer, will control furnaces operating at from 300 to 1,100 deg C. This company also has a high speed recorder with full scale deflection across a 10in chart in 2 sec for 500 μV d.c. input. A recording resistance thermometer for recording temperatures below the range normally covered by thermocouples is shown by Fielden (Electronics), Ltd., and it is at present available for temperatures of 0–100, 0–200 or 0–300 deg C. This company is also demonstrating its "Servograph" electrical recorder which can be supplied with full scale deflection as low as 50 μA.

The Nash & Thompson industrial furnace controller will switch currents of up to 15 A with a temperature differential of 2 deg C between 0 and 1,000 deg C and, by means of electrically operated valves, gas and steam furnaces and ovens may also be controlled.

Among the control apparatus of the British Thermostat Co., Ltd., is the "Teddington" Series ZA electric proportioning equipment, which is based on a modified Wheatstone bridge circuit and provides remote proportioning control of power units and valves under changes in temperature, pressure, humidity or liquid level. Those interested in the measurement of temperature should not fail to visit the stand of the Cambridge Instrument Co., Ltd., for the display covers almost the entire field of temperature measurement and the latest techniques in this connection are being demonstrated in an admirable manner.

Among various items of specialized educational equipment W. B. Nicolson (Scientific Instruments), Ltd., have a simple Geiger counter and a low power ultrasonic generator. The latter can operate at either of two frequencies (1 or 5 Mc/s) which can be selected at will by the operator, the apparatus being completely self-contained and operating from normal a.c. mains. An interesting range of educational instruments is also displayed by W. & J. George & Becker, Ltd.

Another supersonic instrument is the Kelvin & Hughes portable flaw detector which is shown alongside pen recorders, and a snap action altitude switch designed to



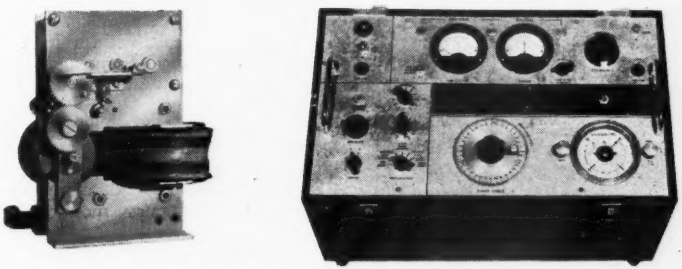
Muirhead permanent magnet d.c. machine and (*right*) Evershed and Vignoles servo and f.h.p. motors

break on the ascent between 35,000 and 40,000ft and to " make " on the descent at about 35,000ft. For servo application there is a 50 c/s motor generator comprising a low inertia, high torque induction motor which has built integrally with it an induction generator giving a linear " voltage output against speed " characteristic.

Small electrical machines are now being used to an increasing extent in instruments, particularly in servomechanisms and regulating systems. In this connection Muirhead & Co., Ltd., have a permanent magnet d.c. machine, which is a variable speed motor with a no-load speed range of 600 to 2,000 r.p.m. and possesses a shunt characteristic by virtue of the permanent magnet field. The speed is controlled in a novel manner by rotating one of the two field magnets so as to change the flux in the field. Also on view is a two-phase permanent magnet alternator with a frequency proportional to the speed, and 50 c/s hysteresis motors for 50 V and 110 V operation.

The small machines exhibited by Evershed & Vignoles, Ltd., comprise a selection of special f.h.p. motors for d.c. and a.c., those for use in servomechanisms having a high torque/inertia ratio. Some of the motors include generators for providing a damping component proportional to speed so as to increase stability and avoid hunting. The generators in the d.c. machines are of the permanent magnet type with the minimum of ripple, while on the a.c. machines they are of the drag cup type having therefore minimum inertia. The motors, which are usually arranged for flange mounting, can also be supplied with integral gear boxes.

Londex, Ltd., also has an interesting machine in the form of a constant speed



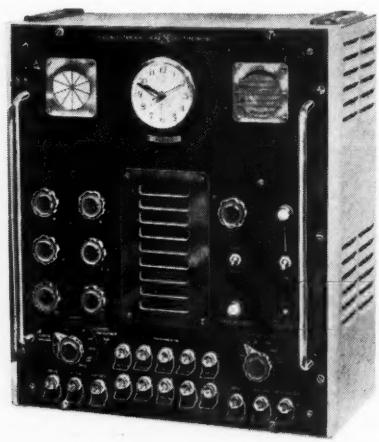
Londex constant speed d.c. motor and (*right*) Vickers-Armstrongs harmonic response test gear

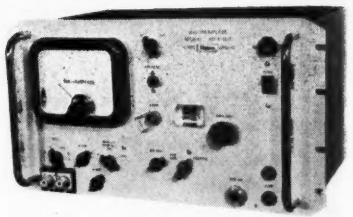
d.c. motor which is rated at 0·25 W and is suitable for operation from dry batteries. The normal gear train fitted to the machine operates a cam which revolves once in 30 sec; a contact arrangement is provided. The principle of operation is considered to be new and is based on the flexible mechanical coupling of a reed to a motor rotor.

In the same field of activity Vickers-Armstrongs, Ltd., have an instrument which provides a quick and simple means of determining, experimentally, harmonic response curves for a complete servo system and for its component units. It gives direct reading of response amplitude on a meter, and of phase on a manually operated phase scale, the pointer on which agrees with the direction of the vector on a conventional Nyquist diagram. The general principle is quite simple and is based on the method of determining coefficients in a Fourier series.

An interesting illustration of the way in which electronic techniques are promoting advancement in fields other than those of a purely engineering nature is the "Aviscope" made by Avimo, Ltd. This instrument furnishes higher magnifications than have hitherto been possible with the optical microscope, with the advantage that living cellular structures and semi-transparent sections may be fully analysed. This is not possible with the electron microscope, which

Airmec frequency standard





Part of Plessey waveguide test bench equipment

can be used only for examining dry structures and shadow castings.

Perhaps the most interesting demonstration by the Plessey Co., Ltd., is that of waveguide test bench equipment. Here facilities are provided for linear frequency and square wave modulation techniques on all types of Klystrons, with either visual presentation or selective amplification of the small resulting signals. The power supplies are designed for extreme flexibility with minimum tolerances on ripple voltage and stabilization. Amplifier and modulator specifications cover all normal requirements with some selectivity in hand for marginal measurements.

The Mullard high stability crystal controlled master oscillator with automatic frequency correcting unit has a range of 0·5 to 1·5 Mc/s and a free running stability of ± 5 parts in 10^8 per day. It is shown beside a stable multi-range oscillator for communications receivers, a generator of high power ultrasonics in air and a demonstration of the measurement of eddy current losses in ferrites.

A frequency standard shown by Airmec Laboratories, Ltd., gives pulse and sine wave signals at 1 Mc/s, 100 kc/s, 10 kc/s, 1 kc/s and 100 c/s. A cathode ray tube and associated amplifiers are incorporated for visual frequency comparison and a separate heterodyne circuit with a loudspeaker is provided for aural frequency comparison. A short time stability of about 1 part in 10^6 is achieved.

An electronic frequency meter with ranges between 5 c/s and 250 kc/s and an accuracy of ± 2 per cent is displayed by Cinema Television, Ltd., alongside a 1 Mc/s automatic frequency monitor. There is also a precision mutual and self-inductance bridge with a range extending from 0·1 μH full scale to 30 mH full scale, the resistance range being calibrated from 0·01

nic hms full scale to 3,000 ohms full cal accuracy is within ±1 per cent of ull ale on all ranges.

P cision inductance and capacitance rid s are on the stand of H. W. Sullivan, td together with inductance and capaci- an standards for all frequencies, audio nd carrier frequency oscillators, d.c. esis nce standards and bridges, and alv nometers.

T high voltage Schering bridge of Gar rell Bros. & Co., Ltd., is for the nea irement of power factor and capacity f i ulators on site. The bridge and the tan ard loss-free gas-pressure condenser are nounted in a screened metal frame- wor the insulation of the components and oper ting handles being such that the brid e can be operated with one corner earthed or at the maximum of 50 kV to earth. Other exhibits include a portable high voltage fault locator, a standard pote tiometer suitable for oil immersion, and oil testing equipment.

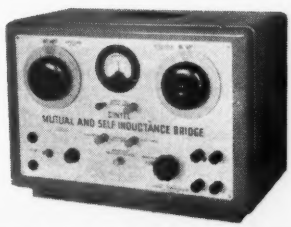
Among the precision instruments of the Doran Instrument Co., Ltd., is a general purpose d.c. potentiometer with three ranges of 1·8, 0·18 and 0·018 V, each division of the slide wire representing 100, 10 and 1 μV respectively. A reflecting galvanometer, standard cell and 2 V accumulator are housed in the same case. Another self-contained instrument is a new thermocouple potentiometer with ranges of 16 and 18 mV.

The precision potentiometers on the stand of W. G. Pye & Co., Ltd., are accompanied by a device which makes use of an entirely new principle for comparing accurately two nearly equal voltages. It also illustrates one application of a recently developed mechanical interrupter for the conversion of d.c. into a.c. signals. Another instrument measures pH values to an accuracy of 0·01 pH unit. To combine the accuracy of a manually balanced potentiometer with the convenience of a direct reading instrument a self-balancing potentiometer is used; it is geared to a four-figure counter indicating pH values directly.

Apart from valve voltmeters, pH meters and other similar apparatus, Electronic Instruments, Ltd., show a vibrating reed electrometer derived from an A.E.R.E. design which represents what is probably the ultimate stability in an instrument of this type. The input resistance is 10^{17} ohms and the long-term stability of the amplifier is better than ±100 μV. The unit is used for measuring minute ionization currents which occur in nuclear research work down to 10^{-16} A.

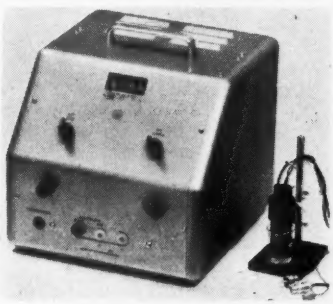
Apart from a portable high voltage insulation test set operating from battery or mains, Panax Equipment, Ltd., has a Geiger-Müller counting equipment incorporating a stabilized h.v. supply with a range of 0–2 kV, indication being by a linear scale moving coil meter. Neon interpolation is provided with a reset control and a mechanical register can be switched to give scales of 8, 16 or 64. In the same field of activity Dynatron Radio, Ltd., has a 30-valve scaling unit embodying the latest circuit techniques for use either with a Geiger-Müller tube through a probe unit or an ionization chamber through an amplifier. The input circuit accepts the positive going pulses from either of these arrangements and has a stabilized discriminator facility, allowing only those pulses above a predetermined amplitude (in the range 5 V–50 V) to be counted.

The wide range radiation monitoring



Cintel mutual and self-inductance bridge

Pye automatic self-balancing potentiometer and pH meter with electrode system



apparatus shown by the Baldwin Instrument Co., Ltd., includes an improved model of the " Atomat " beta-ray or weight gauge which measures the weight per unit area of sheet materials by the absorption of beta radiation. The new E. K. Cole scintillation counter is especially designed for medical use. It is 13in high and 3·25in in diameter and comprises an eleven-stage photo-multiplier tube, an interchangeable phosphor and a wide band amplifier having three switched values of gain. It thus forms a complete unit suitable for directly operating a scaler or ratemeter.

A new type of scaling valve, the " Dekatron," is now in an advanced stage of development and its mechanism is demonstrated by Ericsson Telephones, Ltd. The instruments demonstrating the use of these valves include a high accuracy interval timer, for periods between 1 millisecond and 10 sec, an " add-on " counter, and a frequency-difference meter, which makes use of two-way driving and " carry " circuits permitting the long-term integration of frequency errors.

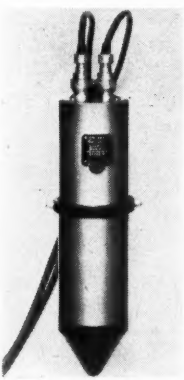
The Dekatron register unit demonstrated by Labgear (Cambridge), Ltd., has been designed expressly to replace the G.P.O. mechanical register in any scaling unit. It allows fuller utilization of the short resolving time inherent in " classical " electronic scales-of-ten and will operate independently of a scaling unit up to 12,000 counts/min with absolute accuracy. It thus affords an improvement factor of 25 : 1, registering closely spaced pulses when employed with a scaler.

Special purpose valves are exhibited by Ferranti, Ltd., together with a 32-pen high speed recorder which uses voltage sensitive paper thereby overcoming the fundamental limitations of the conventional pen recorder. There are no moving parts in the device and input frequencies of 2,000 c/s and above can be recorded without distortion. This company also shows a slow speed relay computer designed to demonstrate the technique of the automatic solution of logical problems.

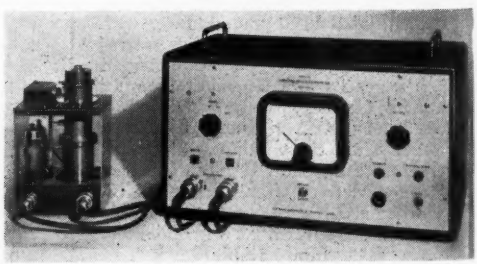
Elliott Brothers (London), Ltd., have digital computing elements using magnetostriction. There is a static storage system and also a digital accumulator wherein the stored number circulates in a regenerative loop comprising a magnetostriction delay line with its associated electronic circuits and a device which permits numbers to be added or subtracted from the stored number. The total delay within the loop is 60 μsec, providing a storage capacity of twenty 3 μsec binary digits.

Right: **Labgear " Dekatron " register unit**

Below: **E. K. Cole scintillation counter**



Below: **Electronic Instruments vibrating reed electrometer**



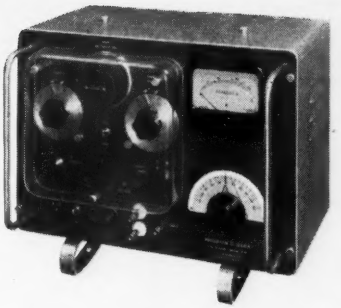
The Edison Swan Electric Co., Ltd., also shows a range of special purpose valves together with a display of recently designed gamma and beta ray monitors, a multi-channel pen-oscillograph equipment and a stabilized power unit for general laboratory use. The last-named has an adjustable output of 120–250 V at 50 mA, the stabilization providing for an output change of less than 0·15 V for an input change of 10 V or for a load change between 0–50 mA.

The growing use of stabilized power supplies for instruments has created a demand for voltage stabilizers of high operating speed and an example of such a regulator developed for this purpose is shown, together with a variety of laboratory and instrument fixed and variable resistors, by the British Electric Resistance Co., Ltd., illustrating the damping mechanism employed to prevent hunting.

Lightweight stabilizers for 400 and 50 c/s operation and for inclusion in other equipment are displayed by H. Tinsley & Co., Ltd., who also have a new portable battery operated potentiometer and a very sensitive double spot galvanometer. On the main light spot the latter has an equivalent scale distance of 1·5 metres giving a sensitivity of 2,200 mm/μA for a resistance of 450 ohms, while the second " indicator " spot has one-tenth of this accuracy. Automatic voltage regulators for current loadings between 30 and 100 A are shown by the Zenith Electric Co., Ltd., as well as its well-known range of " Variac " regulating transformers.

An interesting item on the stand of Dawe Instruments, Ltd., is an electrolytic condenser re-forming equipment alongside which is a production test set for matching the reactance and magnification factor of coils and condensers in the frequency range 100 kc/s to 25 Mc/s. There is also an ultrasonic thickness gauge and a number of stroboscopic instruments.

As usual, Sangamo Weston, Ltd., has a representative selection of its high grade laboratory and aircraft instruments and associated apparatus, together with its newly designed slim and " streamlined " universal and ciné " Weston Master II " photographic exposure meters. The Automatic Coil Winder & Electrical Equipment Co., Ltd., has a selection of multi-range meters, valve voltmeters, signal generators and other radio test-gear. Multi-range test sets are also displayed by British Physical

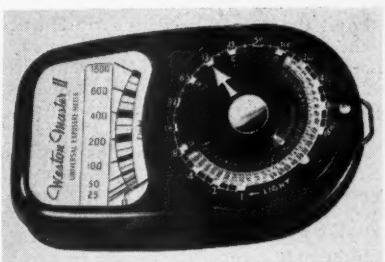


Dawe production " Q " comparator

Laboratories, Ltd., together with various bridges and signal generators. Indicating instruments of all types are displayed by Measuring Instruments (Pullin), Ltd., Nalder Bros. & Thompson, Ltd., and the Electrical Instrument Co. (Hillington), Ltd. The Sifam Electrical Instrument Co., Ltd., includes in its display an audible Braille type milliammeter.

The increasing scarcity of some non-ferrous metals has led the Telegraph Construction & Maintenance Co., Ltd., to investigate the production of alloys and materials which employ more abundant elements. The various items on view include magnetic materials, aluminium-clad iron and a resistance alloy, known as " Telconal," which has similar characteristics to Constantan. Zirconium metal, tantalum, molybdenum, tungsten and sintered permanent magnets are shown by Murex, Ltd., and Johnson, Matthey & Co., Ltd., are exhibiting examples of resistance wires, electrical contacts, thermocouples, waveguide tubing and silvered mica capacitors.

" Weston Master II " exposure meter



VIEWS on the NEWS

By REFLECTOR

UNPLEASANT though price increases are to electricity consumers, some in the Eastern Area may find a redeeming feature in the new tariffs which the Board has just introduced. This is the special night rate which will operate between 9 p.m. and 7 a.m., the running charge being ¾d/kWh instead of 1d. It is unfortunate, I think, that the Board should find it necessary to add 13s (single-phase) or 19s 6d (three-phase) to the quarterly fixed charge. This is likely to scare many people off, for after all ¾d/kWh is a high enough price for off-peak energy. Nevertheless the principle is sound from both the Board's and consumer's points of view.

* * *

The good work done through personal visits to dissatisfied consumers was noted at a Consultative Council meeting which I attended last week. Looking through the reports, I came across several examples illustrating the effectiveness of this method. In one, a consumer complained that the Board was supplying him with electricity which " was of no value, the voltage having dropped below 200." Accordingly, he had claimed a rebate which he had deducted from his electricity account. In due course the consumer (a Wing Commander and D.S.O.) was visited by a member of the Council (a Brigadier and C.B.E.). The report records that the full account has now been settled.

* * *

From the nearest television transmitter to the Isle of Man is a long way (probably about 120 miles) and yet it seems that Manxmen are picking up the television signals there—and grumbling about the quality of reception. I am not surprised that they are subject to a good deal of interference. For this they blame the h.v. lines of the Isle of Man Electricity Board. An " expert on radio interference " is reported by the *Isle of Man Times* as saying that the only cure for the trouble seemed to be the re-insulation of the 33 kV lines. He suggested that a section of a mile should be re-insulated and tested. As the cost of re-insulating the lines was said to be £30,000, it is not to be wondered that the Electricity Board has displayed no enthusiasm for the proposal.

* * *

In a train the other day a fellow passenger was reading the *Electrical Review* and I noticed that it had on the front cover a slip bearing seven names. This led me to wonder when the seventh on the list would get the *Review*. I guessed that it might take a fortnight to reach him. But this was nothing unusual; I have known one copy to pass round twenty-four people, making the last man something of a history student. It is inexplicable why a firm which considers it necessary that certain members of its staff should read a technical or trade journal cannot go to the really small expense of providing more copies and thus enable its people to keep up to date.

* * *

It is generally thought that the American electrical utilities concentrate on the sale of electricity and leave the " merchandising " (*Anglice*, " selling ") of appliances to the dealers and distributors. There are exceptions to this. Recently the Union Electrical Co., St. Louis, told a gathering of dealers, distributors and others interested in the sale of electrical appliances that it proposed to extend its activities (so far confined to lamps and small appliances) to include cookers, water heaters, freezers and dryers. It justified this by pointing to its great capital expenditure on lines to rural districts which had to be properly loaded to secure an adequate return. There was an implication that the dealers and distributors were not doing enough active selling. The *Electrical World* which reports the occasion does not say what views, if any, were expressed by the dealers, etc.

Water-Power Alternators

Review of Design Features

THE design of high speed salient-pole a.c. generators for water-power plants was the subject of a paper presented last week by Messrs. E. M. Johnson and C. P. Holder (Metropolitan-Vickers Electrical Co.) before the Supply Section of the Institution of Electrical Engineers. It was in effect a companion paper to that given previously by the authors (*Journal I.E.E.*, 1948, Vol. 95, Part 2, p. 757) on large vertical-shaft machines.

The authors said that recent developments in Francis turbines and in multi-jet Pelton wheels had made feasible rotational speeds of 300 to 1,000 r.p.m. and normal peripheral speeds of about 15,000ft/min, at which stresses due to centrifugal force began to determine design. Peripheral runaway speeds, which usually decided the form of rotor construction, were about twice the normal figure. Particulars of twelve large generators in service or under construction were tabulated; the largest, of 122 MVA, and two others of 36 and 62·5 MVA were of British make. Salient poles for such machines were more economical than those in which rotor windings were embedded in a steel cylinder.

In all designs the rotor body was subdivided to ensure homogeneous material and to permit of transport, which, however, was not generally difficult with diameters up to 12ft 6in. Individual component discs were in one piece. Owing to the large radial air gaps (at least two-thirds of the width of stator slots) solid poles did not entail undue pole-face losses and resulted in more even distribution of centrifugal force, which allowed larger rotor diameters and hence greater outputs. Although generally more costly, they might obviate the need for damper windings.

Methods of attaching the poles to the rotor body were of major importance, since the limiting stress usually occurred there. Field coils were almost invariably of copper strap. Large coils were fabricated by some makers from straight lengths of copper without bending, which eliminated any tendency for the strap to thicken on the inside of the bend and permitted of high width-thickness ratio. Among other advantages of fabrication was the ability to use silver-bearing copper with its resistance to creep at high temperatures.

Asbestos was generally used for inter-turn insulation of field coils and moulded insulation and flat insulating boards of cotton or glass fabric, bonded with a synthetic resin, for insulation from the pole body. The avoidance of field-coil clamps improved ventilation, but the extra cost of special designs for this purpose only was, in the authors' view, rarely justified, although sometimes necessary for large generators to enable poles to be removable with the rotor in position in the stator.

Stator frames, usually fabricated, were often divided to facilitate transport or removal of the rotor in a confined space. Horizontal division was to be preferred. The method of construction of the stator core was similar to that for all large generators. The two-layer diamond winding was usual since, compared with concentric winding (the greatest clearances given by which were important only at 22 kV and over), it had lower reactance, better cooling, identical interchangeable coils and not more than half the number of joints.

Other aspects dealt with included bearings, ventilation, limits of output and flywheel effect.

DISCUSSION

Prof. M. G. Say (Heriot-Watt College) opened the discussion by stating that in these hard times the British manufacturers of electrical plant were helping us to keep our heads above water. Continental and American manufacturers of the type of plant described in the paper had the tremendous advantage of a market on their doorstep; but to manufacture machines which were almost entirely for export, and of which the design had to be such as to enable them to be erected and run with the

minimum of trouble at a great distance from their place of manufacture, must create many problems. It was clear that mechanical considerations would overshadow purely electrical considerations in high-speed machinery; rotational forces arose alarmingly with size, weight and speed.

When comparing possible high-speed ratings of water-wheel generators with steam turbo-alternators of comparable size at comparable speed, it must be remembered that the water-wheel generator must sustain 100 per cent overspeed and the steam turbo-alternator perhaps only 10 per cent. The diameter of the former, consequently, could be only one-third that of the latter and its capacity 1/27th. Centrifugal forces would dominate some aspects of the design; the limiting features appeared to be the dovetail stress in the base of the poles and the yoke or rim stress, which would tend to limit the peripheral velocity at overspeed to about 30,000 ft/min.

Mr. L. D. Anscombe (B.T.H.) pointed out that much of the development hitherto of these large high-speed machines had been in the hands of Continental manufacturers, but three British designs, by three well-known manufacturers, were now under construction. A 70 MVA alternator at 500 r.p.m. now running in Austria was said to be able to develop 90 MVA, though he doubted whether the prime mover was actually capable of that.

The authors rightly emphasized the value of the fabricated field coil for use in these large high-speed machines. These coils had been introduced into this country by his firm shortly after the end of the war and up to the present they had completed over 20 machines with them, totalling about 300,000 kVA, and the results justified the enthusiasm felt for that type of coil. With regard to the future, if the technique of water turbine manufacture could be further improved, as might happen when cavitation problems were mastered, there might be a demand for even larger machines.

Mr. J. B. Young (English Electric Co.) emphasized the general tendency towards larger kVA ratings of individual units and the fact that British engineers were ready to play their part in providing them. His firm, he said, was responsible for the 122 MVA at 327 r.p.m. generator being manufactured in this country, which represented a considerable advance in output at that speed. While from the points of view of production and transport 12ft 6in was usually the limiting rotor body diameter, it had been possible in this case to go to 13ft 9in, and on the basis of a core length/pitch ratio of 4·5 the output should be about 160 MVA.

Mr. P. G. Ross (B.T.H.) suggested that synchronous reactance was a better criterion of steady-state performance than the short-circuit ratio which the authors used in their present paper. He also showed a slide which indicated that if a very low transient reactance was required, say one which was only half the " natural " value, the cost of the alternator would be increased very considerably.

Mr. J. W. Pollard (Kennedy & Donkin) said that the dissipation of heat from these high-speed rotors might be an important factor in their design, and asked whether hydrogen cooling, with its many advantages, would be feasible for these machines.

Mr. B. Adkins (Imperial College) suggested that the benefit obtained from the fabricated field coil tended to be cumulative. As a result of its advantages it was possible to cool the coil better and also to reduce the height of the pole; that in turn reduced the leakage across the poles and the stresses in the poles, resulting in an immensely greater saving than was apparent at first sight.

Mr. C. P. Holder, replying to the discussion, said the size of such a water-wheel generator was usually determined by the requirements of governing or of system stability, and the only advantage of hydrogen cooling would be to reduce the windage loss, so that the saving would not outweigh the greater complication involved.

Essay Competition

THE Council of the Institution of Works Managers announces an essay competition; prizes of £100 in the senior grade and £75 in the junior grade are offered. The competition is open to anyone employed in industry in the United Kingdom within certain age limits, except for those who have previously received an award. The subject is "What are likely to be the Structure and Problems of Works Management in 1977."

Students are notified that the final examinations of the Institution will be held on 20th May. Those intending to take the examinations should communicate with the general secretary.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

"Nationalized Inertia"

YOUR anonymous author's article on this subject is both welcome and timely and will, I am sure, provoke discussion. I was myself once in the industry but turned over to lecturing in order to follow my bent, that of engineering, of which one does less and less as one becomes more and more administrative.

The main complaint under the former arrangements was about policy and was not a criticism of the administration. True, greater efficiency could have been obtained with slightly more expenditure but it is difficult to reconcile the immediate increase in expenditure to operate a running concern when in the main it was policy only that required changing.

As I see it, any nationalized industry will run at a loss because of its own inertia. The only exception would seem to be the Post Office and from information I have gathered from a person who has switched from the Post Office to another ministry the Post Office employees are the most hard worked. But they do not seem to be burdened with Area Boards, etc.

The main problem is the selection of the right man for the job. Paper qualifications have become increasingly important and personal attributes, which cannot be measured except in terms of output, of less importance. Again once a position is filled, however unsuitably, the occupant remains, while a number of others suffer, including the public. In private industry such a one would be quickly corrected or removed. Those in charge do not seem to have the measure of, or to be in touch with, what is going on at "the tail end of the feeders." They do not seek to check the validity of the reports they receive—if they read them: how can they then be in touch?

I do not know why insurance was not nationalized and the other industries left alone. In this way the Government would have had a measure of control in a large number of concerns which would nevertheless still require to show a profit. This alone ensures efficient working. We are not sufficiently spiritually advanced to make any other system work.

We are sick with the accumulated poisons of a machine age and nothing short of a renaissance of spiritual values will save us as a nation.

GEO. M. HART.

THE author of this article is critical of the principle of nationalization. He covers a wide field but I propose to confine my remarks solely to the electricity supply industry.

The test of the success or failure of a public utility organization is the price paid by the consumer. Table 43 of the Returns issued by the Ministry of Fuel and Power for 1947–48 sets out the revenue and expenses of all British undertakings in the year before nationalization. There was a net surplus of revenue over expenditure of £3·176 million after meeting all charges. Lord Citrine has stated that many undertakings were running at a loss, but he omitted to say that a far greater number were running at a profit, which resulted in an overall surplus.

Why then are price increases necessary? The answer that suggests itself is to meet the costs of the top-heavy administration of the B.E.A. and Area Boards.

At the time of nationalization many prominent men in the industry predicted that with the greatly increased resources at the disposal of the new authority, there would be an unprecedented expansion of output which in turn would reduce costs to the consumer.

It has been stated again by many prominent men that had nationalization not taken place, many undertakings would have been compelled to increase their prices. Those of us who remember those days, also recall the firm stand taken by the Electricity Commissioners who consistently refused to allow undertakings to increase prices until the reserve funds had been expended. The B.E.A. "inherited" the reserve funds of undertakings at vesting day, amounting to £208 million (Ministry of Fuel and Power

Returns). Some day someone will ask what has happened to these funds.

Anyone in contact with consumers to-day knows that there is not the friendly reception that existed in the good old days. My own experience every time I go to see a consumer now is that he invariably asks " Is this another increase? "

Consumers have suffered severely from power cuts and have been inconvenienced much more than they were in pre-vesting days. Many of us who were brought up in the school of " reliable and continuous supply " are sad to see young men entering the industry and being instructed in the art of " switching off " in substations when the need arises—apparently without concern.

From the point of view of the staff it is deplorable that men who have spent their lives in this industry rising by public competition to management posts should be subordinated to new importations many of whom have had little, if any, previous experience of management. The working methods of the present organization are most discouraging to those who have been used to progress, while frustration is daily blunting all the enthusiasm of staffs.

This great and formerly happy industry has been built up over a period of 60 years by having men in command, responsible to a council or a board of directors, who have been trained in the business. Training involved many years of work in each section of the industry, so that when a man reached the management chair he could discuss the work of any department with skill and from experience. He was able and free to make decisions on the spot. Now those who are capable of making such a decision—as distinct from the political importations—are hampered by regulations. The present system, unless it is checked, will produce a moribund industry.

The principle of nationalization is sound —it is the organization which is faulty. The suggested remedy is to dissolve completely the present organization, including " members " of the B.E.A. and Area Boards —together with all their large administrative headquarters staffs.

The present boundaries of the fourteen Area Boards could remain and District Boards could be formed of local authority representatives (unpaid). In each area a seat on the Board should be given to each town council whose annual sales of electricity on vesting day amounted to 50 million kWh or more. For the management, it is suggested that the former borough electrical engineers and managers and company managers should be re-installed, to report *direct* each month to the newly constituted Area Boards. Each Area Board should engage and employ as a servant and not as chairman, a regional controller whose duty would be to act as technical adviser to the Board.

Each Area Board should appoint annually its chairman and vice-chairman from among the elected representatives. It is further suggested that the chairmen of the Boards should serve on a National Board which could meet in London—say four times a year. By this means national policy could be determined.

In addition the Central Electricity Board should be re-instituted with exactly the same powers as it had before vesting day and the Electricity Commissioners should be restored to control financial and technical matters.

These recommendations are put forward in the hope of restoring to its former efficiency what was one of the happiest of this country's industries. To-day it is neither efficient nor happy. Furthermore, it is becoming, if it has not already become, cumbersome—so much so that nearly every Area Board and Division has to publish a monthly magazine—for which the staff have to pay. These magazines are supposed to deal with items of mutual interest to Boards and employees. Their value is questionable and the people employed in preparing and printing them could be more usefully employed. Their very publication is in itself a condemnation of the present machine—which is so big that it has lost the personal element and the personal touch, to the general detriment of all concerned. " DISILLUSIONED "

Thermocouple Compensation

A COLOUR code for twin compensating cables for thermocouples is specified in B.S. 1843 which not only indicates the kind of couple with which the cable is intended to be used, but also the polarity of the individual conductor. Each cable consists of a pair of wires of such temperature-e.m.f. characteristics that, when properly connected, the reference junction will in effect be extended to the other end of wires. Copies (1s post free) are obtainable from the British Standards Institution, 24, Victoria Street, London, S.W.1.

THEATRE RE-EQUIPMENT

New Stage Lighting Installation at Drury Lane

WORK has recently been completed by the Strand Electric and Engineering Co., Ltd., on the re-wiring and re-equipment of Drury Lane Theatre. The new stage lighting installation has a total connected load now balanced over the three phases of a four-wire a.c. supply of over 350 kW.

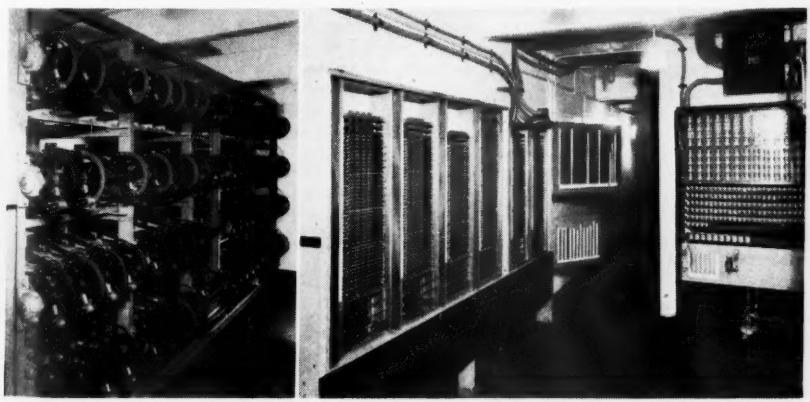
A compact three-manual Strand light console erected in a small room on the " prompt " side of the stage within the proscenium arch has brought all the controls, including those for remotely operated colour changers on the auditorium lanterns, within the reach of a single operator. The slave dimmer banks controlled by the console are under and at the rear of the stage. Since there are 216 dimmer ways, the saving in space by using remote control has been very considerable. The footlight and No. 1 batten, both 42ft long, provide four colours wired with two circuits per colour. Battens 2 to 8 inclusive, each 3ft longer, are similarly connected. All are supplied through plug boxes with change-over switches so that when the battens are not actually in use the circuits can be utilized for other purposes. The hanging equipment also includes a spotbar fitted with sixteen 1 kW spotlights and a cyclorama top floodlight bank consisting of thirty-two 1 kW lanterns controlled in four colours.

At fly level on actors' left are two 24-way plug boxes with plugs in pairs and three similar 8-way boxes. Three more 8-way boxes are fitted at the same level on actors' right. Two single-way boxes at both sides are also provided for decorative fittings. Lower down at perch level are four 2-way boxes and, at stage level, four points for float spots and sixteen 4-way dips or floor plug boxes. For lighting the bottom of the cyclorama are two 4-way boxes, one on each side and wired across stage. A 75 A effects box to cope with special requirements has been provided on each of the three phases.

In the auditorium are twenty-six 1 kW mirror spots. All are fitted with remotely operated 4-colour changers. The " following " spotlights —four 90 A a.c. high intensity sunspot arc lanterns—are situated in the special projector room at the back of the auditorium gallery. Cueing to the various parts of the stage is carried out from a 28-way switchboard in the " prompt " corner.

The opportunity was also taken of installing an up-to-date emergency lighting apparatus. The old d.c. intake room was stripped out and turned into a battery room in which are now housed 110 Chloride DBG4 cells, capacity 120 Ah at the 10-hour rate, arranged on double-tier wooden stands. This battery, operating on the Keepalite " floating " system, powers secondary lighting points all over the building. The consulting engineers were A. E. Mohring & Son, and the architect, Mr. J. Emberton.

Left : **Part of one of the electro-magnetic clutch-operated dimmer banks remotely controlled from the light console.** *Right :* **The main relays between the light console and the dimmer banks. The remotely controlled colour change switchboard can be seen on the right**



NEW BOOKS

Microphones. By the Staff of the B.B.C. Engineering Training Department. Pp. 114; figs. 78;. index. Published for the *Wireless World* by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 15s.

This book, which was originally written for use in training B.B.C. engineers, commences by setting out the requirements for microphones in a broadcasting studio. Subsequent chapters deal with laws relating to sound waves and their behaviour in which the design and characteristics of various types of microphones are described. Full details are given of the ribbon, moving coil, crystal and condensing instruments which have been used in B.B.C. studios during recent years.

The book should be of particular value to students but its specialized nature assumes that the reader already has a basic knowledge of electrical engineering, particularily a.c. theory.—R.P.

Three-Phase Motors (Theory and Operation). By T. F. Wall. Pp. 232; figs. and index. George Newnes, Ltd., 37, Essex Street, London. W.C.2. Price 30s.

In this up-to-date book the author deals with the theory, operation and application of three-phase motors in general. While mechanical power is most commonly obtained from three-phase mains by the use of induction motors there are many other types of three-phase motors, which have been included in this treatise. In addition to a comprehensive treatment of induction motors, synchronous motors and three-phase commutator motors, there is an interesting chapter on the " Selsyn " and " electric-shaft " systems. While such combinations of machines are very useful for remote control and remote indication, we are also reminded that the " electric-shaft " or " electric-tie " has many heavy-current uses such as the driving of the two columns of a portable loading bridge, weir gates, textile machines, annealing furnaces and bakers' ovens. There are many other drives on which such a system could be used with advantage.

Other important matters covered are the starting of induction motors by the usual means and also by the " Kusa " method and the use of an auxiliary motor; together with braking by d.c. injection and the measurement of braking torque by " running-down." Attention is given to the problem of power factor and its improvement, and methods of speed control. Other features of special interest are the operation of a mesh-connected induction motor with the L connection, and the " Kloss " formula. The treatment adopted is mathematical, liberal use being made of vector algebra.—J.L.W.

Servomechanisms. Pp. 293; figs.; H.M. Stationery Office, York House, Kingsway, London, W.C.2. Price 63s.

In this book there are collected together a series of seventeen reports on research work carried out under the direction of the Ministries of Supply and Aircraft Production, now combined as the Ministry of Supply. Those of the reports which deal with original problems cover such subjects as the interpretation of Nyquist diagrams, the solution of algebraic equations by graphical methods, the evaluation of the roots of quartic equations and the rapid evaluation of the roots of equations of fifth and sixth degree. Other topics include the design of such components as the velodyne, quick response sense detecting rectifier circuits, smoothing and re-transmitting mechanisms and aided landing systems. The effect on the efficiency of servomechanisms of such factors as the presence of air in the oil of hydraulic systems and the linearity of the voltage speed characteristics of small d.c. generators used as tachometers is also covered.

The book is illustrated by figures and there are a number of circuit diagrams of typical servomechanisms and their components.—R.P.

Books Received

Calculation of Unsymmetrical Short-Circuits. By H. Rissik, revised by W. F. Lovering. Second edition. Pp. 54; figs. 22; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 12s 6d.

Éléments d'Optique Électronique. By Gaston Dupouy. Pp. 218; figs. 81; bibliography and index. Libraire Armand Colin, 103, Boulevard Saint-Michel, Paris. Price 260 fr.

House Wiring

Alternative Systems of Installation

By "Commentator"

It is opportune, now that shortage of steel conduit in which to enclose circuit wiring is being re-experienced at home, to reflect that the relative merits of concealed metal conduit and tough rubber sheathed (t.r.s.) surface wiring, or lead covered cable, for house wiring are likewise exercising the minds of executive engineers within the Engineering Directorate of the Government of East Bengal, Pakistan.

In response to a request from that country for an expression of opinion on the subject, I may say that I have during the last 20 years used all three systems on a very considerable scale. In my view the lead covered type is probably not so good as a good t.r.s. cable. It is more difficult to "work," requires greater skill, and cracking of the lead sheath is by no means unknown. The two effective alternatives for house wiring are steel conduit and t.r.s. Provided that they are properly installed, it would be difficult to choose between them either on the scores of safety or durability. There are, however, other considerations.

Provision for Rewiring

For instance, t.r.s. was originally introduced as a surface wiring system and an enormous amount of it was so used when converting houses from gas lighting to electric lighting. When building a new house, however, some system of concealed wiring is considered essential. Moreover, since the house may be expected to last much longer than the rubber cable, it is good practice to adopt a method which will allow rewiring without having to cut the walls or ceilings about. For this reason metal conduit became the standard method of wiring, mainly because it provided a permanent throughway into which cables could be drawn at any time during the life of the building. It is tempting to think that one could avoid the cost of conduit and still get the throughway if the builder would leave ducts or channels in the structure. I have investigated all sorts of proposals for built-in ducts and I have yet to find one so convenient, so adaptable, or so cheap as steel conduit.

Now, although the I.E.E. Wiring Regulations allow the use of t.r.s. cable buried directly in the plaster (subject to Reg. 404) it is quite clear that when the time comes to renew a cable, or cables, substantial cutting away and making good will be required. In the case of a house built to sell, the fact that rewiring may be required in, say, 30 years time has not greatly concerned the builder in the past, or even the first purchaser, so t.r.s. wire was often buried direct. In the case of a housing authority or landlord intending to let and maintain the house for the next 60 years or more this point is of obvious importance. If t.r.s. were used, some way of making it a rewirable system would have to be devised.

In the case of the traditional small English house this was not very difficult. The floors, ceilings and roof space were all of wood and were always accessible at any time without any particular trouble. The only place where there was no throughway was in the walls and this obstacle was overcome by burying short lengths of light-gauge conduit in the plaster. Carried out in this way there was little to choose between this system and a complete light-gauge conduit job while the prices were about the same. In blocks of small flats, however, where the floors are generally of concrete, this method has not been practicable and a complete conduit system is the only practical alternative.

Ducts through Concrete

The shortage of steel conduit to-day has compelled me to wire all small houses in t.r.s. with short lengths of conduit in walls. For flats, however, I see no alternative to conduit. I am nevertheless making some experiments with a proprietary system* which, by means of a withdrawable rubber

**Electrical Review*, 17th Feb., 1950, p. 317.

tube, leaves circular ducts through concrete floors and indeed through the building generally. In view of the fact that these *in situ* concrete " conduits " may be damp I am taking the precaution of using t.r.s. cable therein, or the p.v.c. type. On present experience I would consider it inadvisable to use ordinary braided rubber cable.

This new system seems to me to be the most promising of the non-metallic ducts I have seen, but it is too soon to say if it will in the end prove to be cheaper or better than metal conduit. At present its main attraction lies in the fact that conduit is so difficult to get. Incidentally, I have found in the case of conduit runs which are subject to condensation that p.v.c. gives better results than braided rubber cable.

Going back, therefore, to the original inquiry as to what system of house wiring to use in Pakistan, my reply would be that if it is to be a concealed system the choice would lie between conduit and t.r.s., depending on the nature of the structure. If, as I think is possible, the floors and ceilings are concrete then it looks as though the choice must be conduit. I would not expect excessive condensation in buried conduit, provided care is taken to avoid pockets (such as U-shapes) which are not self draining; U-shaped runs can cause trouble in any country. I am not sure that condensation is worse in India or Pakistan than it is in England. I spent some time in Bombay during the monsoon and cannot remember many electrical troubles due to condensation. The air was often very damp and fabrics and paper absorbed moisture, but there was so little variation of temperature that there was little condensation on surfaces. If the conduit were in fact damp, I would use p.v.c. covered wiring.

Fuel and Power Policy

IN a booklet of 72 pages entitled " Ten Steps to Power "* Mr. G. Nabarro, M.P., has set out his views on a " national fuel policy " as a basis for immediate legislation. The proposals, in so far as they relate to electricity supply, are in the main vitiated by non-recognition of basic factors that have long been accepted in all leading industrial countries. It is also assumed that certain methods having restricted fields, such as the generation of electricity as a by-product of district heating or of process steam, are of general application.

Coals, whether they be the untreated slack averaging 10,900 B.Th.U./lb burned in electric power stations or the large high-grade coking coal of upwards of 25 per cent greater heating power which is required for gas making, are evidently regarded as all of the same value. As compensation for being " driven " off electricity for all purposes except lighting and small appliances by the tariff " weapon," millions of people are to have the coal thus saved returned to them either as an addition to their ration or as gas. Yet, as Mr. V. W. Dale (E.D.A.) has pointed out in *The Times* recently, such coal would be useless to the householder. It would also be useless to gasworks, or for export, or for any other appreciable industrial use.

The Government is exhorted to reverse the policy of the B.E.A. and the Area Electricity Boards—a policy which they inherited from companies and municipalities and which is in accordance with world engineering trends during the past half century—by multiplying the number of small stations and the subsidizing of local diesel generation by imported oil fuel. There appears to be some uncertainty as to whether fuel saving or avoidance of load shedding is here intended. That there is a difference between the cost of giving continuous or stand-by supplies to consumers as required and the value of surplus output of industrial generating plant dumped on the grid at any time seems to be imperfectly appreciated. Many figures are given to illustrate the high expenditure required under present methods, but none of the all-in cost that would be incurred by the author's proposals for achieving the improvements all desire.

* St. Catherine Press, Ltd., 39, Parker Street, London, W.C.1, price 3s.

Work at Owen Falls

Accelerated Construction Programme

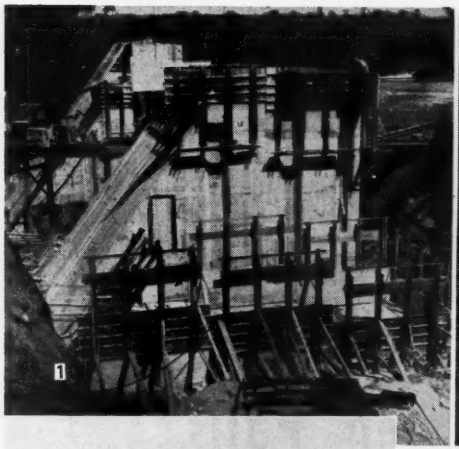
IN under two years' time the Owen Falls hydro-electric scheme on the Victoria Nile is likely to be formally inaugurated. Speaking on the occasion of the recent opening of a modern housing estate for the African workers and their families, Mr. C. R. Westlake, M.I.E.E., chairman of the Uganda Electricity Board which is carrying out the project, looked forward to this event as "ushering in a new era of prosperity for all classes of the community, and especially for the African."

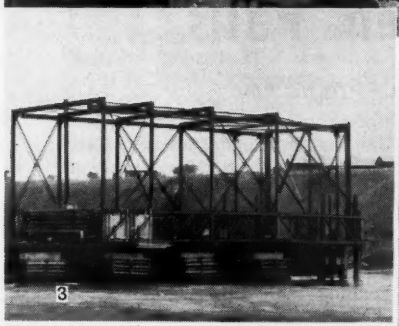
The Protectorate has already thriving cotton, coffee and tobacco growing industries and industrial development has also begun. Two examples are a cement works at Tororo, where the demand is likely to be of the order of 2,500 kW by next May, and the Nyanza textile factory which, when in full production, is expected to need 15,000 kW. Other possible developments are the smelting of copper, phosphorus fertilizer production, and iron and steel industries.

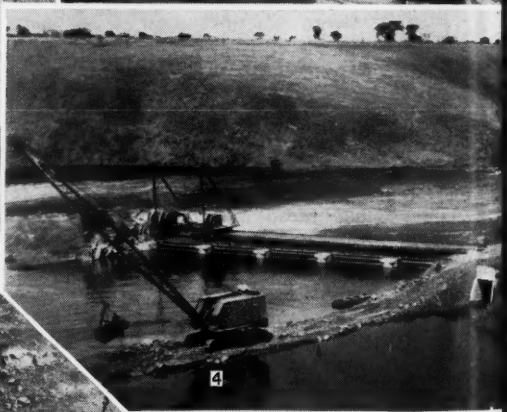
The main requirement is an adequate supply of cheap power, and the Board's fourth report, just published, tells of the progress that has been made in this direction. Pending the commissioning of the Owen Falls station, provision has been made for some 15,000 kW of temporary thermal plant to meet the expanding demand. Since the Board took over, the number of consumers has doubled (6,836 against 3,263 in 1948) and last year 24·6 million kWh was sold compared with 16·4 million kWh in 1950.

The four-year contract for building the Owen Falls station was placed in September, 1949, with British and Dutch firms which formed the Owen Falls Construction Co. The contract price was £3,639,540

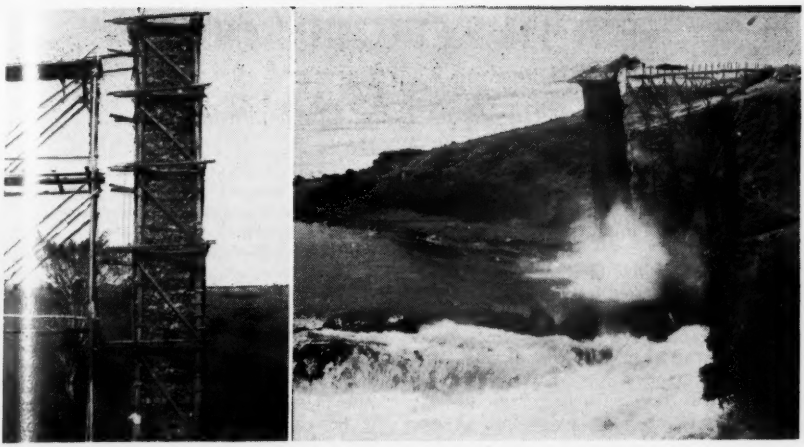
and by the end of last year the value of work certified amounted to £1,470,000. Abnormally high rainfall rather hindered the work, but an accelerated programme approved by the Board made it possible to carry out a number of important operations during night shifts. Concrete construction for the first two 15,000 kW sets (ten are planned) was well advanced and by the end of 1951 the main steel framework for the power station building had been commenced. The total concrete placed by the end of 1951 amounted to 7,200 cu yd, including 4,000 cu yd in the main dam. Preparations were completed for precasting the concrete structures for the outdoor switching station. A point of interest is that it has been possible to achieve an appreciable saving in cost and time by using local marram for the power station







1. Main dam seen from corner of east headrace. 2. Intake dam reinforcement in floor of transition curve to intake looking downstream. 3. Coffer dam (main dam) showing start of steel piling. 4. Ripon Falls weir: dragline removing coffer dam. 5. View of intake dam looking north, showing mass concrete pillars between intakes. Photographs 1 and 2 were taken on 21st February this year and the remaining three in January



Ripon Falls barrier-tower completed and (right) base of tower blasted, tower falling forward

coffer dam instead of steel sheet piling. Further economy will result from the use of the river banks as natural earth dams, so avoiding the necessity for extensive cut-off walls at the ends of the main dam.

To facilitate and reduce the cost of construction, the contract provided for control works at the Ripon Falls outlet to Lake Victoria so as to limit the flow of water to some 600 cu m/sec (compared with the maximum recorded flow of 1,200 cu m/sec). Temporary sluice gates were built on a spur of land jutting from the east bank but there were difficulties in blocking the west falls. The problem was solved by building a timber tower 70ft in height and 10ft square which was filled with rock and the front supports blasted away by explosive charge so that the 500-ton tower fell across the channel, to act as an artificial ridge for a rubble dam.

The Board's activities included the erection of a number of transmission and distribution lines. A 66 kV line from Jinja to Kampala (45 route miles) was completed and is being operated temporarily at 33 kV, while a 33 kV line from Jinja to Tororo (75 route miles) was also commissioned. A second 33 kV line is being erected from Kampala to Entebbe and an 11 kV extension of the Kampala–Namulonge line as far as Bombo. New distribution systems have been constructed at Tororo, Iganga and Lugazi.

The Board's accounts show that the total cost of carrying out the programme of works approved up to the end of 1951 is £17,640,001, of which £9,988,503 is for the Owen Falls scheme. The year's revenue was £272,686 (against £152,612) and there was a surplus of £43,060 which has been set against interest on loans, being equal to 85·6 per cent of the total interest paid on capital employed in the production of revenue. No provision has, however, been made for redemption of loans, or for depreciation of fixed assets. Despite rising costs, it is hoped to maintain tariffs at their present levels so as to encourage the largest possible load by the time the hydro-electric station comes into commercial use.

Power from Maraetai

THE Maraetai hydro-electric station on the Waikato River in New Zealand is expected to be producing power in October. Three generators will then begin partial production, and the remaining two generators are expected to be ready next year. The station's total production of 180,000 kW will increase the North Island's present supply by 40 per cent. Announcing this, the Minister of Works, the Hon. W. S. Goosman, said the work had progressed well and was up to schedule, allowing for the delay caused by the strike last year. The Minister said that a large number of men would be transferred from Maraetai to Whakamaru, the next big station up the river.

SOUTH AFRICAN NOTES

From Our Cape Town Correspondent

ARTISANS and labourers in the electrical contracting and servicing industry in the Cape Province are getting about 3d an hour more in basic pay and other improved conditions of work under a new agreement negotiated by the new Industrial Council for the Electrical Contracting and Servicing Industry (Cape), which now solely controls electrical work in the Cape Province. Under the new agreement operatives in the contracting section of the industry will have an extra 22s a week added to their cost-of-living allowance. The allowance for the other employees will continue to be based on the war measure scales

The contracting section gets better overtime rates. There will be paid annual leave and a special bonus of £32 10s a year for all. Employees will get three weeks' leave and four paid public holidays every year. In Natal a similar agreement for electrical workers has been reached and will come into effect shortly.

According to a recent Monthly Bulletin of Statistics of the United Nations Organization, more electricity is at present being generated in the Union than in any other country in the southern hemisphere, although Australia is a close second to South Africa.

J. A. Crabtree (Pty.), Ltd., Springs, Transvaal, are now in quantity production of their new Lincoln combined flush-switched socket outlet which has been designed to meet special South African requirements. The new product has a 15 A quick-make-and-break switch with a 15 A three-pin (round pin) socket outlet on a single base designed for flush mounting in the type of box now generally used in the Union. South African porcelain is being used for the base.

Power transformers up to 750 kVA are now being built in Port Elizabeth by a new company associated with Aberdare Cables. The new company has a link with a leading transformer manufacturer in Britain and is able to use the testing and laboratory facilities of its associated companies. These companies also supply electric conductors, tanks and many of the components required by the transformer company.

The spreader stokers to be installed in the Hex River power station at Worcester, Cape Province, will be the first installation in the Union of this type of stoker. The boilers will have a maximum continuous rating of 200,000 lb/hr. The coal to be used in this station will have a calorific value of 11,600 B.Th.U./lb as received, and 17 per cent ash. The spreader stoker should be well adapted to cope with anticipated variations in grading.

The stokers at the new Vierfontein power station are being provided with small refractory front arches below the level of the water-wall tube headers. Automatic adjustment of the front secondary air pressure will help to control the point of ignition in relation to the feed bar. Apart from this the furnace design is conventional.

Royal Institution Documents

LETTERS and manuscripts in the Cavendish Laboratory archives were the subject of the Friday evening discourse by Sir Lawrence Bragg last week at the Royal Institution. The laboratory has a collection of letters and manuscripts bearing on the history of physics during the last hundred years. The collection includes all the letters, manuscripts and papers which were left to the laboratory by Clerk Maxwell, together with his scientific apparatus. These show the development of his ideas about the teaching of physics and, in particular, there are letters and notebooks about the creation of an experimental physical laboratory as distinct from a school of mathematical physics. These ideas are surprisingly modern, being well in advance of his time. There are many letters to Maxwell from Faraday, Kelvin, Tate and others. The Rutherford papers include his correspondence with many famous men concerned in the early work on radioactivity and provide a wealth of information about the development of their ideas. There is much of J. J. Thomson's correspondence and numerous other treasures. It is a collection which is in many ways unique and of the greatest interest to students of the history of science.

PARLIAMENTARY NEWS

From Our Special Reporter

In the House of Commons last week Mr. Leslie Hale asked the Secretary of State for the Colonies what progress had been made with the construction scheme at the Owen Falls; and what was the intention of the Government with regard to the initiation and continuation of the schemes of land reclamation in the Blue Nile Valley.

Mr. Lyttelton said that work was nearly up to schedule. The foundations for the first two generating sites were almost completed and the walls of the power station were under construction; 15,000 kW should be available from the hydro-electric station by September, 1953, and a further 45,000 kW by the middle of 1954. The second half of the question was within the responsibility of the Foreign Secretary.

Mr. Hale asked if it would not be better if the whole of the work, including the very important ancillary schemes of flood reclamation, were controlled and planned by one Department.

Mr. Lyttelton said that they were dealing with the geographical facts. No part of the Blue Nile flowed through colonial territory, and it was unfortunate that inter-Departmental boundaries were governed by geographical and not by economic facts.

Replying to Mr. James Griffiths, Mr. Lyttelton promised to consider arranging a small exhibition in the Palace of Westminster, perhaps accompanied by photographs of the Owen Falls scheme.

Scottish Schemes

Mr. M. K. MacMillan asked the Secretary of State for Scotland in which areas of the Outer Hebrides electricity distribution schemes were to be put into operation this year by the North of Scotland Hydro-Electric Board.

Mr. Henderson Stewart said he was informed that work on electricity distribution was proceeding, and would continue throughout the year, in the western part of the Island of Lewis and in an area between the west and Stornoway.

Rating of Private Plant

Mr. Nabarro asked the Chancellor of the Exchequer whether he was aware that valuers acting for the Board of Inland Revenue sought to increase rating valuations for property where independent electricity generators were installed, even if they were for emergency stand-by use only; that such increased valuations were not consonant with the Government's policy of stimulating and encouraging independent electricity generation; and whether he would instruct the Board to cease this practice.

Mr. Butler said that where the annual value of premises was enhanced by the presence of an independent electricity generator (which was part of the rateable plant) an Inland Revenue valuer was not entitled in law to disregard such additional value in making a valuation of the premises for rating purposes. He regretted therefore that he was unable to issue the instruction suggested.

Television

Mr. F. Harris asked the Assistant Postmaster General when a decision would be made to transfer television broadcasting from Alexandra Palace to the Crystal Palace.

Mr. Gammans said that the B.B.C. was carrying out tests to try to find a suitable site for a new television transmitting station if it had to move from Alexandra Palace when the current lease expired in 1956. Several alternatives were being examined and it was too early to say when a decision would be made.

Mr. Hector Hughes asked the Assistant Postmaster General what television reception tests for North-East Scotland had been made recently by his Department; and with what results.

Mr. Gammans said that no such tests had been made by his Department. The B.B.C. had carried out tests from sites in North-East Scotland to see whether they were suitable for a television station. The results were being studied by the Corporation but for the present no work would be done on setting up a station.

Mr. Gammans told Mr. Hughes that the Postmaster General realized that there was a demand for television in the north-east of Scotland, as well as in other parts of the United Kingdom. Provision of a station at Aberdeen was postponed by the last Government owing to defence and economic reasons and for the present he could not alter that decision.

Mr. Watkins was informed by Mr. Gammans that the B.B.C. expected that the low-powered television transmitter at Wenvoe would provide a satisfactory service to Glamorgan, Monmouth, part of Brecknock, the greater part of Somerset and parts of the adjoining counties. Reception would be more liable to interference, particularly in the fringe areas, than it would when the high-powered transmitter came into service.

Telephone Applications

Replying to Mr. Hobson, Mr. Gammans said that the number of applications outstanding for telephones was 486,712 on 31st January, 1952, and 543,045 on 31st January, 1951.

Mr. Vane asked the Assistant Postmaster General what priority was given to applications for telephones put in by branch offices of nationalized industries, and if he would give an assurance that the available lines were shared fairly as between these applications and those of private businesses.

He told Mr. Vane that no priority was given to a nationalized industry in the matter of telephones simply because it was nationalized. The criterion for granting priority was that the industry concerned, whether nationalized or not, was providing essential services to the community or engaged in rearmament or the export trade.

Thermionic Valve Supplies

Commander Noble, Parliamentary Secretary to the Admiralty, informed Mr. Watkinson that the production of thermionic valves was planned by an interdepartmental committee, and he was satisfied that all practicable steps were being taken to meet the requirements of the naval programme.

Inverness Exhibitions

THE North of Scotland Hydro-Electric Board is holding two exhibitions in Inverness next week. These are an electrical economy exhibition, to be held in the Northern Meeting Rooms from 7th to 12th April, and an electrical-agricultural exhibition, to be held in the Rose Street Drill Hall from 8th to 12th April. There will be no charge for admission.

The purpose of the electrical economy exhibition is to illustrate how savings can be made in power consumption and at the same time to show how hydro-electric development is contributing to the well-being of the Highlands. Over thirty manufacturers will be presenting approximately 2,000 individual exhibits chosen for the exhibition because they are both economical and efficient to run. Demonstrations, film shows and competitions will focus on economy, electrical and financial.

The exhibits will range from model water turbines to electrically heated aquariums. In the entrance hall there will be the larger pieces of electrical equipment, such as model turbines and a model of a complete hydro-electric scheme in a Highland setting showing power being carried to a large industrial concern. The ballroom on the first floor will hold the main exhibits. In the supper room, the Commercial Section will contain exhibits of interest to hotel, boarding house and restaurant owners. The exhibition will be opened by Mrs. J. Grigor, the wife of the Provost.

The electrical-agricultural exhibition is a new venture for the Board. It will be the biggest exhibition devoted solely to electrical appliances for the farm and croft ever to be held in Scotland. Exhibits will include sack hoists, grain elevators, automatic hammer mills and oat-crushers, freezers, graders, slicers, poultry pluckers, bottle washers, milking machines, sterilizers and many other new electrical appliances for the farm. There will be a farm workshop in which hand-operated electric tools will do repair jobs, a horticulture section, a display of farm pumps, and an incubator section.

In connection with the exhibition a farmers' engineering "quiz" is being held at the Art Centre at 7.15 p.m. on 8th April, the panel including Mr. F. E. Rowland (president, B.I.Agric.E.), Mr. P. Finn-Kelcey (agricultural engineer, E.R.A.) and Mr. J. C. N. Baillie (development engineer, North of Scotland H.-E. Board).

The electrical manufacturers who are taking part in the exhibitions are as follows:—

Jackson Electric Stove Co., Ltd.; Carron Company; Hobart Manufacturing Co., Ltd.; British Co-operative Electric Lamp Co.; L. Sterne & Co.; A. Reyrolle & Co., Ltd.; Johnson & Phillips, Ltd.; Duncan Low & Co.; Electrolux, Ltd.; Craigpark Electric Cable Co., Ltd.; Simplex Electric Co., Ltd.; General Electric Co., Ltd.; Vactric, Ltd.; Wilkins & Mitchell; Ferranti, Ltd.; English Electric Co., Ltd.; Bruce Peebles & Co., Ltd.; Philips Electrical, Ltd.; Hoover, Ltd.; British National Electrics, Ltd.; Land, Speight & Co., Ltd.; Sangamo Weston, Ltd.; Aluminium Casting Co., Ltd.; Scottish Cables, Ltd.; Harland Engineering Co.; Metropolitan-Vickers Electrical Co., Ltd.; British Thomson-Houston Co., Ltd.; and the Edison Swan Electric Co., Ltd.

Development in Quebec

IN the 16,000 sq miles of Quebec served by the Shawinigan Water & Power Co. industrial activity was at an even higher level last year than in 1950. Pulp and paper, chemical, metallurgical and other industries operated at or near full capacity, and furthermore many new industries were established. This, as the company's report shows, resulted in a record peak power load, and sales of electricity rose by 14·8 per cent to 7,538·4 million kWh. Although the 325,000 h.p. Trenche development was brought into operation during the year the additional power was quickly absorbed and attention was directed to securing further supplies. Since 1939 the system generating capacity has been expanded from 886,400 to 1,562,700 h.p. A sidelight on the company's activities mentioned in the report is the passing of logs through the company's hydro-electric plants with the least possible loss of water for power production. During the log driving season an average of 30 million logs are floated down the St. Maurice River and passed through specially designed chutes.

Commerce and Industry

Electric Motors and "Interference"

Copper and Zinc Allocations

THE Postmaster General has appointed an Advisory Committee of twenty-one members from a panel nominated by the President of the Institution of Electrical Engineers, with the approval of the Council, to consider the requirements which might be prescribed in regulations dealing with interference with wireless telegraphy caused by small electric motors. The members of the Committee are:—Mr. J. R. Beard, C.B.E., M.Sc., M.I.C.E., M.I.E.E., Fel.A.I.E.E. (chairman); Mr. L. Austin, M.I.P.E.; Mr. A. H. Ball, A.M.I.E.E.; Mr. J. L. Bernard, B.Sc.Tech., M.I.E.E.; Mr. N. R. Bligh, B.Sc. (Eng.), A.M.I.E.E.; Mr. J. S. Boyd; Mr. A. H. Cooper, B.Sc.; Mrs. M. Courtney, J.P.; Mr. W. J. Edwards, B.Sc.; Mr. J. Flood, Associate I.E.E.; Mr. F. Gratwick, A.C.I.S.; Dame Caroline Haslett, D.B.E., Companion I.E.E.; Mr. H. J. B. Manzoni, C.B.E., M.I.C.E.; Major C. A. J. Martin, G.C., M.C., B.A., A.M.I.E.E., R.E.; Mr. W. A. H. Parker, M.I.E.E., Mem.A.I.E.E.; Mr. E. L. E. Pawley, M.Sc. (Eng.), M.I.E.E.; Mr. G. F. Peirson, M.I.E.E.; Mrs. C. Renton Taylor; Mr. V. A. M. Robertson, C.B.E., M.C., M.I.C.E., M.I.Mech.E., M.I.E.E.; Mr. W. A. Scarr, M.A.; and Dr. S. Whitehead, Ph.D., M.A., M.I.E.E.

Navigational Aids at Capetown Fair

A display piece featuring aids to navigation supplied by the Marconi International Marine Communication Co., Ltd., is included in the British industry exhibit arranged by the Central Office of Information at the Van Riebeeck Festival Fair which opened at Capetown on 14th March. The Fair celebrates the 300th anniversary of the landing of Van Riebeeck in South Africa.

The Marconi Marine display is a modified version of that which formed part of the company's contribution to last year's Festival of Britain in the Kelvin Hall, Glasgow, and demonstrates how the direction-finder and echometer assist the navigator.

Tower Bridge Traffic Signals

Traffic signals by the Automatic Telephone & Electric Co., Ltd., have recently been installed at the approaches to Tower Bridge, London, and provide a clear indication of conditions to approaching traffic when the bridge is either open or closed. Control of the signals at both approaches is from either the east or west cabin situated at the north end of the bridge. The operation of a master switch initiates an immediate change to amber and after three seconds the signals change to red. When the switch is restored a red/amber signal is displayed for three seconds followed by the green. If desired, either the south or the north approach may be controlled independently. Indication lamps are installed in the control cabins. The existing alarm bell signals which have been in use since 1894 have been retained and will be rung during the amber and red/amber periods.

Traffic over the Tower Bridge is now controlled by traffic signals

Refrigerator Conference

Members of the Coldrator Distributors' Association and of the International Refrigerator Co., Ltd., met in London on 13th March, under the chairmanship of Mr. R. G. Brandon, commercial director, to discuss sales promotion. The speakers were Messrs. W. J. Creemer, K. R. J. Cocke (director and chief engineer), H. K. V. Babbage, C. W. Barrett and J. Taylor. Mr. Brandon, in his concluding address, stressed the importance of meeting the high export quota which had to be achieved this year, though this would reduce very considerably the

supply of domestic refrigerators in the home market. The annual general meeting of the distributors followed the joint meeting, when Mr. Creemer was re-elected chairman.

Ekco Victor Agreement

Under an agreement concluded with the Victor Animatograph Corporation of Davenport, Iowa, U.S.A., E. K. Cole, Ltd., are to market in Great Britain and certain overseas territories the Victor 16 mm film projector manufactured in this country. The new marketing organization which is being set up by E. K. Cole, Ltd., to handle the product, under the direction of Mr. A. J. Brunker (general export manager), will pay special attention to the development of its potentialities in overseas territories. To this end, they will have the co-operation of Mr. R. Kulka, a vice-president of the Animatograph Corporation, who will assist with marketing planning. Mr. J. C. Rogerson has been appointed manager of the new department which will be known as the British Victor Division, with headquarters at 5, Vigo Street, W.1, the London offices of E. K. Cole, Ltd.

Quality of Electric Lamps

Recently a complaint was received by the South Eastern Electricity Consultative Council that the "life" of electric lamps was shorter than before the war. The subject came up again at last week's meeting of the Council when it was reported that letters had been received from a hospital supplies officer confirming that there had been complaints from several hospitals to the effect that lamps were not lasting as long as before. The South Eastern Electricity Board, however, reported that lamps were constantly being tested and the results did not support the suggestion that there had been any deterioration. Of twelve "ring" lamps tested recently nine gave 1,300 hours' life or more, one 1,276 hours and two 1,000–1,200 hours. In the case of "non-ring" lamps eight gave more than 1,300 hours, three 1,200–1,300 hours and one 857 hours. Only those "non-ring" lamps which were known by tests to give good results were stocked. Details were also given of tests on street lamps.

Brook Motors

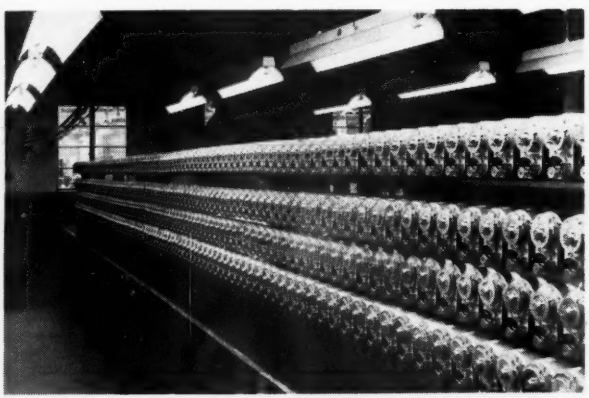
In 1904 Mr. Ernest Brook, founder and first chairman of Brook Motors, Ltd., commenced the design and production of a.c. electric motors. He started in a small workshop with one or two helpers, and the business has so grown that over 2,400 people are now employed. Some interesting facts regarding the development of the company are given in a booklet just issued entitled "About Ourselves." This is handsomely produced in colour, and describes, with numerous illustrations, the manufacture of the company's motor and control gear.

Voltage Transformers

In the note under this title published on page 628 of our issue of 21st March we should have explained that the points to which the author (Mr. N. Ashton) draws attention arose from modifications made to his original text during preparation for printing.

E.C.A. Branch Activities

Speaking at the annual dinner and dance of the Plymouth Branch of the Electrical Contractors' Association, at the Duke of Cornwall Hotel, Plymouth, on 19th March, Mr. S. N. Watkins, president of the Association, who was accompanied by Mrs. Watkins, made an appeal to both the British Electricity Authority and private industry to concentrate on greater efficiency and a better service to the public. Each section should specialize more than ever before, but within its own limits. Overlapping of interests meant inefficiency, which neither the industry nor the country could afford. Mr. Watkins was responding to the toast of "The Allied Associations and Honorary Officials," proposed by Mr. N. Axford, district manager of the South Western Electricity Board. Other speakers were

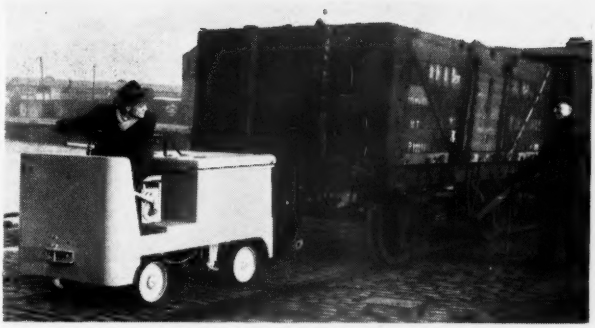


An array of switches under test showing the new, small, electrically-wound, spring reserve, Venner time switch, type T.J.S.S.P.

Alderman R. Baker, Lord Mayor of Plymouth, Mr. C. J. Penrose, Mr. E. R. Gardiner (chairman of the Plymouth Branch), and Mr. J. F. Knape.

The annual dinner and dance of the North Worcestershire and Staffordshire Branch of the Electrical Contractors' Association was held at the Talbot Hotel, Stourbridge, recently, when Mr. A. H. Gwilliam of Dudley presided. The toast of "The Association" was proposed by Councillor G. F. Clarke (president of the Stourbridge Chamber of Trade), and Mr. S. N. Watkins responded.

Mr. Gwilliam proposed the toast of the guests and in reply Mr. C. R. Heathcock (Midlands Electricity Board) said there was nothing in the world equal to the ever-increasing demand for the manifold services of electricity. He had a long stay in America last year, and found it was straining their vast production to the utmost to keep their generating plant a face in front of demand.



Electric tractor being used for shunting railway wagons

Electricity Staff Salaries

Mr. L. G. Moser reports in the April number of the official journal of the National Association of Local Government Officers that no decision was reached on the staff side's claim for a 15 per cent increase on existing provisional salaries at a meeting on 5th March of the National Joint Managerial and Higher Executive Grade Committee, Electricity Supply Industry.

"Xcel" Appliances

An arrangement is announced in our advertisement pages whereby Elexcel, Ltd. (in members' voluntary liquidation) has agreed to the Selex Electric Co., Yardley Road, Kirkby Trading Estate, near Liverpool, manufacturing and supplying certain spares required for the servicing and maintenance of "Xcel" cookers and other products previously manufactured by Elexcel, Ltd. Arrangements are also being made to transfer outstanding orders for such spares received by Elexcel or by the liquidators, to the Selex Electric Co. Claims for free replacements of faulty parts under guarantees issued with "Xcel" products should also be sent to the Selex Electric Co.

Electric Shunter

A demonstration of an "Electric Eel" battery operated tractor used to tow or push any form of trailer or railway wagon, as well as shunt wagons, was given recently to the Railway and Port Authorities at Dundee. The tractor is one of Steels Engineering Products' standard units with a maximum drawbar pull of 1,200 lb. It incorporates two series wound traction type motors with a controller giving three forward and two reverse speeds. For a 10-hour day the running cost is claimed to be only 4½d to 6d. The illustration is reproduced by courtesy of the *Dundee Courier & Advertiser*.

Non-Ferrous Metal Allocations

The Washington correspondent of *The Times* reports that the Copper-Zinc-Lead Committee of the International Materials Conference has announced its recommendations for the second quarter of the year. Of a total allocation of 723,680 metric tons of copper the United States is to receive 355,600 tons and the United Kingdom 97,200 tons. The United States' share of zinc is 235,800 tons and that of the United Kingdom 67,000 tons, out of a total of 510,145 tons.

Aluminium Price Increase

As from Tuesday last the price of virgin aluminium in ingot form (99–99·5 per cent purity) was increased from £148 to £154 per ton delivered into consumers' works. The addition of £2 10s a ton for metal in notched bar form is maintained as are the premiums for ingots of higher purity.

Manufacturers' Jubilee

Heenan & Froude, Ltd., Worcester, celebrated their fiftieth anniversary of incorporation on 29th March. The late Mr. Hammersley Heenan founded the firm in 1880, shortly afterwards taking into partnership Mr. R. Hurrell Froude, the eldest son of William Froude, F.R.S., inventor of the Froude hydraulic dynamometer. The resultant company was incorporated under its present title in 1902.

The company specialized during its early history in the building of bridges and other steel

structures, and built the Blackpool Tower. The Froude dynamometer soon, however, became its principal product with, later, the manufacture of water and closed circuit air coolers and a wide range of automatic machines for the wire, strip and chain industries playing an increasingly important part in the overall picture. During the last war Heenan & Froude equipped the test sections of many of the shadow factories established to produce vehicle and aircraft power plants. The company's current order book is at the highest level ever and in the case of the larger type dynamometers two-thirds of the orders by value are for overseas. An equally well-known side of Heenan & Froude's activities is their manufacture of refuse disposal plants and incinerators.

To commemorate its golden jubilee the company has produced a well-illustrated brochure showing some of the products of the Heenan & Froude group of companies.

Columbus-Dixon Organization

An important change has taken place in the constitution of the hitherto associated companies Columbus, Ltd., and R. G. Dixon & Co., Ltd., of Capitol Works, Empire Way, Wembley, Middlesex. With effect from 1st April, these companies have formed a single marketing organization known as Columbus-Dixon, Ltd. With the merger of these two companies, a combined leaflet has been produced which illustrates and describes the full range of products of the new organization.

Trade Announcements

Brush Coachwork, Ltd., has recently appointed Standard Batteries, Ltd., 43, Forbes Street, Fort, Bombay, as its sole distributors for India. Brush trucks will be shipped in a " knock-down " condition for assembly in the territory and to save the ultimate cost to the user it is hoped to fit Indian made batteries.

Sangamo Weston, Ltd., have now moved into their new London offices at St. George's Court, 22-26, New Oxford Street, W.C.1 (telephone : Chancery 4971).

The head office of **Giles (Electrical Engineers), Ltd.,** including contracts engineers and accounts, is now at 1a, Southampton Row, London, W.C.1. Additional space for display, demonstration and sales is in use at 11, Victoria Colonnade, Southampton Row.

The sales department of **Truvox, Ltd.,** has removed to the new offices adjoining the Wembley Works (telephone : Wembley 1212).

Works Visit

On 21st March members of the Council of the Purchasing Officers' Association, led by their president, Mr. T. L. Garner, paid a visit to the Plessey Co., Ltd., Ilford, Essex. After luncheon at the Valentine Hotel, Gant's Hill, at which Mr. W. Fleming, Plessey purchasing agent, acted as host, there was a tour of the components and equipment divisions. During the tea which concluded the visit, Mr. Garner thanked the Plessey Co. on behalf of the Association for an instructive afternoon.

Cables at Newcastle College

In our issue of 21st March we described the electrical arrangements in the new Stephenson building of King's College, Newcastle-upon-Tyne. W. T. Henley's Telegraph Works Co., Ltd., tell us that they supplied all the cables and wiring used in the building (apart from some subsidiary circuits)—about 29 miles in all. This included 75 yd of 0·1 sq in 3-core, p.i.l.c. 6 kV cable and various lengths and sizes of 660 V cable, ranging from 0·007 sq in 3-core to 0·5 sq in single-core.

Batti-Wallahs' Luncheon

The principal guest at last week's luncheon of the Batti-Wallahs' Society was the Reverend C. W. Armitage, vicar of the famous City church of St. Bride. This historic church, designed by Wren, suffered severely from enemy action during the war, and the Reverend Armitage has been entrusted with the task of its restoration. His enthusiasm for this important task was evident in his address in which he outlined the history of the church, and showed, with drawings, the new church which has been planned, and which will adhere as closely as possible to the concept of Wren.

Catalogues and Lists

Ladybird AMI, 27, Whitcomb Street, London, W.C.2.—Illustrated priced leaflets describing the company's new unit T.V. aerial.

Cooke & Ferguson, Ltd., Openshaw, Manchester, 11.—Technical leaflet (No. 11) on e.h.v. indoor metalclad equipment.

Solway Flowrators, Ltd., Abbey Road, Park Royal, London, N.W.10.—Illustrated technical catalogue (51j) on variable area flow meters.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Technical illustrated folder relating to an electronically controlled 4 kVA spot welder.

Automatic Telephone & Electric Co., Ltd., Strowger Works, Liverpool, 7.—Illustrated folder on modern intercommunication systems (1202).

Visco Engineering Co., Ltd., Stafford Road, Croydon, Surrey.—Illustrated booklets describing the " Visco " range of air filters (521) and rotating self-cleaning air filters (522).

Airdale Electrical & Manufacturing Co., Ltd., Harrogate Road, Apperley Bridge, Bradford, Yorks.—Illustrated leaflet describing unit type 13DD1-6 oil circuit breakers with drop-down isolation (1-152).

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE President of the Electrical Power Engineers' Association for 1952-53 is **Mr. J. L. Moss**, A.M.I.E.E., section engineer (operations and maintenance) in the North Eastern Sub-Area of the London Electricity Board. Before nationalization he was mains and public lighting engineer to Stepney Borough Council. Previously he had served for some years in various positions on the mains staff of Barking Corporation. Mr. Moss was educated and trained at West Ham and East Ham Technical Colleges and with the Barking Electricity Department. He has a long record of local service behind him in E.P.E.A. affairs and in recent years has come increasingly to the front in the national leadership. Mr. Moss is a member of the National Joint Board and the National Joint Advisory Council for the Electricity Supply Industry.

Mr. J. L. Moss

Mr. R. E. Bristow, M.I.E.E., has been re-elected chairman of the Surrey Branch of the Electrical Contractors' Association for the nineteenth consecutive year.

The Council of the Royal Society of Arts has awarded the prize of £50, offered last year under the Thomas Gray Memorial Trust, to **Mr. J. Home Dickson**, of Teddington, Middx, for his "instrument which makes it possible to navigate a ship in fog by means of a direct comparison of a large scale chart and a radar plan position indicator." The prize of £50 offered for a deed of professional merit was not awarded as none of the submissions was considered sufficiently outstanding.

Mr. J. F. H. Tyler, B.Sc.(Eng.), who has been appointed assistant signal and telecommunications engineer, Western Region, British Railways, began his career in the Signal and Telegraph Department, Southern Railway, in 1925. In 1935 he joined the Signal Department, L.P.T.B., and was associated with resignalling at Cromwell Curve, Northern City Line and Neasden before leaving in 1937 to join the staff of the L. & N.E.R. (Southern Area) signal and telegraph engineer, where he was responsible for the planning side of the resignalling in connection with the Liverpool Street-Shenfield and the Manchester-Sheffield-Wath electrification schemes. He was also responsible for the planning and installation of the first sequence switch interlocking installation at Doncaster, until the work was closed down during the war. In 1942 he became senior assistant (general) and in 1943 was appointed assistant (signals). He joined the G.W.R. as assistant to the signal and telegraph engineer in 1947.

The accompanying picture shows **Sir James Swinburne**, Bt., F.R.S., standing by a portrait painted by T. C. Dugdale, R.A., R.P. The portrait was commissioned by the directors of Bakelite, Ltd., and was unveiled by Lady Swinburne after a luncheon to celebrate Sir James's ninety-fourth birthday. Sir James was one of the earliest workers in this country on phenol-formaldehyde resins. He founded the Fireproof Celluloid Syndicate in 1904 and the Damard Lacquer Co. in 1910. The Damard Lacquer Co., together with Mouldensite, Ltd., and Redmanol, Ltd., became Bakelite, Ltd., and Sir James was chairman until he resigned in 1948; he was made hon. president in 1951. He is the senior past-president of the Institution of Electrical Engineers, having been president in 1902.

Sir James Swinburne standing beside his portrait

Left to right: **Messrs. J. H. Savage, S. J. Wilson, A. T. Winder, A. W. McArthur and E. E. Judge**

New appointments dating from 1st April in connection with their three cable factories are announced by W. T. Henley's Telegraph Works Co., Ltd.:—**Mr. J. H. Savage**, M.I.E.E., A.M.I.W.M., is appointed works manager of the company's parent works at North Woolwich, with **Mr. J. C. Duggan** as assistant works manager; **Mr. S. J. Wilson** is appointed general works manager at the Gravesend works; and **Mr. A. T. Winder**, M.I.W.M., becomes works manager of the factory at Birtley, Co. Durham, with **Mr. E. Beetlestone** as assistant works manager. **Mr. A. W. McArthur**, M.I.E.E., M.I.W.M., works manager in charge of the cable factories at Woolwich and Birtley, retired on 31st March, but retains his directorship with special duties in connection with these factories. **Mr. E. E. Judge**, A.M.I.Mech.E., who has been general works manager at Gravesend, also retired on 31st March, but retains his technical directorship of Oakley Bros., Ltd., a Henley subsidiary. He is also retained for special duties at the Gravesend works and the foundry of Oakley Bros., Ltd., Cradley.

Last week Lord Willoughby de Broke, Lord Lieutenant of Warwickshire, on behalf of H.M. the Queen, presented the British Empire Medal to **Mr. P. G. Hibbs**, pattern maker, B.T.H., Rugby. Mr. Hibbs, who has worked in the pattern shop for nearly fifty years, several of them pattern-making for large steam turbine casings, was awarded the B.E.M. in the New Year Honours. On the platform at the presentation in addition to Mr. Hibbs and Lord Willoughby de Broke were the Mayor of Rugby (Councillor L. B. Fox), the Town Clerk (Mr. D. E. Biart), Mr. S. A. Davis (Regional Controller, Ministry of Supply), Mr. E. H. Ball (managing director, B.T.H.), Mr. W. W. Vinsen (director of manufacture, B.T.H.) and Mr. H. L. Satchell, M.B.E. (director and manager, Rugby Works).

Presentation of the B.E.M. to Mr. P. G. Hibbs by Lord Willoughby de Broke

Mr. D. T. Hollingsworth has been appointed chief engineer of British Insulated Callender's Cables, Ltd. Mr. Hollingsworth joined the former Callender's Cable & Construction Co., Ltd., in 1925. After a period of training under a company-assisted student scheme he, in due course, held a senior position in the technical division of the company. Upon the merger of Callender's and British Insulated Cables, Ltd., he was appointed cable research manager. In 1950 he left British Insulated Callender's Cables to become general manager to W. T. Glover & Co., Ltd. In his capacity as chief engineer, Mr. Hollingsworth will be responsible for applied research and the design and engineering application of all products manufactured by the company.

Mr. D. T. Hollingsworth

Mr. K. Scott Adie, governing director of Rowlands Electrical Accessories, Ltd., has been elected president of the Electric Light Fittings Association for the third successive year. A report of the Association's annual luncheon appears in this issue.

Mr. L. Aldridge has resigned from the board of Johnson & Phillips, Ltd.

The fourth annual dinner and dance of the **Telcon Staff Association**, which includes the staffs of the Telegraph Construction & Maintenance Co., Ltd., and Submarine Cables, Ltd., was held on 26th March at the Dorchester Hotel, Park Lane, London, and was attended by over 300 members and friends. Previous functions have been held locally, and the experiment of having the dinner in the West End of London was a popular one. Mr. W. R. Martin (personnel manager and chairman of the Association Council) presided. The toast of the company was proposed by Mr. R. C. Mildner (research manager) and Mr. J. N. Dean (managing director) replied. Mr. W. F. Randall (director) proposed the toast of the Staff Association, saying it had grown into a body which was very energetic in pursuit of the interests of the staff. Mr. Martin, in reply, welcomed the presence of Johnson & Phillips directors and representatives of the J. & P. Staff Association. The dancing which followed was interspersed with an excellent cabaret.

At the Telcon staff dinner: Mr. and Mrs. W. R. Martin and Mr. and Mrs. J. N. Dean

On 19th March, by kind permission of the principal, Dr. Coode-Adams, and the Governors, a cocktail party was given by the president and Council of the **Faraday House Old Students' Association** at Faraday House Electrical Engineering College, following the annual general meeting of the Association. It was an opportunity for some 120 Old Faradians to re-visit the College and take part in a most enjoyable reunion.

Faraday House was founded in 1899 and was a pioneer of the "sandwich system" which provides facilities for practical training in industry. Students spend each alternate year of the four-year course in one or other of the affiliated companies, which include many of the principal engineering and electrical firms in this country. The system has resulted in a very close connection between the College and the electrical industry, and many of its former students are in the front rank of the profession. At the annual general meeting of the Association Mr. D. E. Bird, M.I.E.E., of Messrs. Ewbank & Partners, was elected president for the ensuing year.

The Faraday Players, the Dramatic Society of the **South Western Electricity Board** in Bristol, have just presented their third production, "The Mask and the Face," for five nights in Electricity House Demonstration Theatre, Bristol. This unusual comedy, adapted by C. B. Fernald from the Italian of Luigi Chiarelli, was produced by Peter Daniel in a striking décor by William Fry, and achieved in the intimacy of a small theatre that vital light touch and slickness often missed by amateurs. The Players hope to present "The Mask and the Face" at Torquay during the present month.

In reporting new appointments by Hoover, Ltd., in our issue of 21st March we inadvertently referred to **Mr. W. M. Tribute** as assistant advertising and publicity manager. Mr. Tribute, who is now export advertising manager to the company, was advertising and publicity manager before his new appointment, a position he had held for many years.

OBITUARY

Sir Andrew Duncan.—The death occurred on 30th March of Sir Andrew Rae Duncan, G.B.E., whose public service over nearly forty years was distinguished and varied. He was President of the Board of Trade and Minister of Supply during the last war and had been an administrator and adviser in the iron and steel industry, shipping, mining, sea-fishing and banking. His association with the electricity supply industry lasted for about seven years. When the Central Electricity Board was set up in 1927 Sir Andrew was appointed chairman and he held the position until he became independent chairman of the Executive Committee of the British Iron and Steel Federation in 1934, a post which he held until the war and resumed afterwards.

The late Sir Andrew Duncan

Batti-Wallahs' Society

Annual Ladies' Night

THE informality which marks the ladies' night of the Batti-Wallahs' Society makes the function one of the most enjoyable social events of the season. At last Friday's annual dinner-dance, which was attended by nearly 200 members and friends with their ladies, the speeches were humorous and brief to suit the occasion.

Mr. A. N. East set the tempo in proposing the toast of the president of the Society and his lady, and in a witty speech congratulated the Institution of Electrical Engineers in following the example of the Society in electing Sir John Hacking as its president. Sir John's reply was also in the light vein. He expressed his appreciation of the honour of being elected president for the past year and said how much he had enjoyed his term of office. The monthly luncheons of the Society had been attended by many distinguished men and the addresses had been interesting and varied.

The toast of the ladies was in the capable hands of Mr. Forbes Jackson, who performed this pleasant duty in his own inimitable manner, and the speech-making was rounded off by a charming response by Lady Hacking.

Dancing followed and there was an excellent cabaret. The guests were so loath to leave that dancing was continued beyond the scheduled hour.

(1) Mr. Forbes Jackson proposes the toast of "The Ladies." (2) Mr. A. N. East gives "The President and his Lady." (3) Sir John Hacking (president) and Lady Hacking receive Lord and Lady Citrine. (4) Col. H. J. Wellingham, Mr. T. C. F. Bigland (hon. secretary) and Mr. C. B. Cleland

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

The English Electric Co., Ltd., held its annual meeting on 27th March, Sir George Nelson (chairman) presiding. In presenting the report and accounts the chairman said that the company now had works in Canada, South Africa and Australia, which acted as springboards from which the results of the research and development activity in this country could be made available for the development of the economic resources of those countries. They had endeavoured to provide stable employment for their employees and to do this their manufacturing range had been widened and their distributing activities spread all over the world in such a way as to ensure that a fall in demand for any particular product, or financial or economic disturbances in any part of the world should not have a serious effect on the company's activities.

In Canada their subsidiary, John Inglis & Co., Ltd., raised further capital to finance its expanding business. They now owned a 54 per cent interest in the Canadian group. Production at their Benoni works in South Africa again increased and the South African company continued to receive substantial orders for power plant, transformers and switchgear made in the United Kingdom. The new factory at Brisbane continued to increase its output. There was no restriction or substantial recession in demand for capital goods for which Australia had placed substantial orders with them.

The demands for the defence programme had presented them with the problem of maintaining a just balance between the immediate demands of rearmament and the vital need to earn income from overseas while following a course enabling them to fulfil their basic policy of stability of employment for the staff and workpeople when rearmament declined. Extension of their manufacturing facilities undertaken during 1951 and the acceptance of long-term business had both been related to these considerations. They had added a new bay to their Liverpool works, while at Netherton, near Liverpool, work was at present in progress on the erection of a new factory, the cost of which was being provided jointly by their company and the Ministry of Supply.

Dealing with some of the outstanding engineering events of the year, the chairman said that the British Electricity Authority had commissioned during 1951 1,113,000 kW of generating plant, of which their company supplied nearly one-third. Orders received included the first 100 MW unit for one of the new B.E.A. stations. The year had seen the commissioning of a large amount of hydro-electric plant, including a feathering propeller turbine for the 28,000 kVA set at Tekapo power station in New Zealand, which was one of the largest in physical dimensions ever manufactured in Great Britain. Their diesel engine division business continued to expand both at home and overseas and further orders had been received for diesel electric locomotives. They had in hand a number of important contracts for gas turbines, the outstanding event of the year being the completion of a 6,000 s.h.p. marine gas turbine under construction for the Admiralty. They also had in hand an order for two 20 MW gas turbines which were the largest sets yet ordered in this country.

Among many important contracts for mining equipment completed during the year were two 4,040 h.p. twin a.c. winders and two 1,340 h.p. a.c. winders, all for South Africa. A large three-stand tandem mill for the Steel Co. of Wales, having an aggregate rating of nearly 30,000 h.p., was commissioned. An order had been received from the B.E.A. for 275 kV 7,500 MVA circuit breakers. The transformer business continued to expand satisfactorily.

Last year they had a record of exports for all their domestic equipment, but further expansion in this field was now restricted by the material position and by the limitation of imports into some countries, such as Australia. Sir George concluded with references to their principal subsidiary companies.

Marconi's Wireless Telegraph Co., Ltd.—Speaking at the annual meeting held on 27th March, Sir George Nelson (chairman) said that the value of export sales in 1951 was nearly 50 per cent higher than that of the previous year, which was itself a record year. Sales of their radio communication equipment were again greater and the demand for their high frequency point to point communication equipment and v.h.f. multi-channel radio telephone communication systems continued. Sales of the mobile class of v.h.f. equipment had been maintained both at home and abroad. The entire design and manufacture of the Holme Moss television station had been entrusted to them, and they had also completed the installation of the medium powered transmitters for the fourth great station at Kirk o' Shotts. Orders had been received for complete television stations at Bogota in Colombia, and

through their associates, Marconi Espanola, at Madrid and Barcelona. Television equipment had been ordered for Montreal and Toronto and was already working in Montreal although that station was not due to open until later in the year. The turnover of their subsidiary, Marconi Instruments, Ltd., now exceeded £1,000,000 a year. Research work continued towards the advance of knowledge and technique in the electronic field.

The Marconi International Marine Communication Co., Ltd.—In the course of his speech at the annual meeting held on 27th March, Sir George Nelson (chairman) said that the business continued to expand, again attaining a record level. The incidence of the defence programme was an important feature of their activity. A large proportion of their orders for all their communication and navigational aid equipment came from overseas, and they were maintaining a high level of exports.

A. C. Cossor, Ltd., announce that payment of the outstanding arrears of dividend on the £500,000 6 per cent preference capital, together with the dividend for the year ended 31st March last, amounting together to two years' dividends, will be made to holders at 31st March. The last distribution on the ordinary capital was for the year to 31st March, 1947.

The British Oxygen Co., Ltd., reports a group trading profit of £4,595,414 for 1951, as compared with £4,225,584 for 1950, and after deducting £1,352,945 for depreciation, £1,965,134 for taxation, and £131,012 for outside shareholders, the balance available to the parent company is £1,146,323 (against £1,097,998). It is proposed to place £250,000 to general reserve, and to pay a final ordinary dividend of 12 per cent, making 20 per cent for the year (unchanged). The balance carried forward is £446,722 (against £346,282).

Phœnix Telephone & Electric Holdings, Ltd.—At an extraordinary general meeting held on 26th March, the capital of the company was increased to £461,695 by the creation of 200,000 additional ordinary shares of 5s each. Approximately 190,000 of these shares are being issued pro rata to the ordinary shareholders in the proportion of 19 shares for every 60 shares held at a price of 5s 3d per share.

Copper Price Increase

THE Ministry of Materials has announced that from 1st April the price of electrolytic copper has been increased from £227 to £231 per ton delivered to consumers' works. Discounts and premiums for special shapes remain unchanged. The Ministry of Supply is making arrangements for corresponding adjustments in the controlled prices of scrap and secondary metal.

Refrigerator Interference

THE report of the Postmaster General's advisory committee on wireless interference from refrigeration apparatus, of which Dr. F. T. Chapman is chairman, was published on Tuesday. The committee recommends that the voltage of interference from refrigeration apparatus injected for continuous periods of not less than one-fifth second or more frequently than once in any two-second period into the electricity supply mains should not exceed 1,500 microvolts for the waveband 200–1,605 kc/s or 750 microvolts for the television waveband 40–70 Mc/s. The committee recommends that these requirements should be specified for both new refrigeration apparatus and for that in use, and that six months should elapse between the promulgation of regulations and the time of their coming into force.

River Derwent Pollution

JUDGMENT was given on Monday in favour of the plaintiffs in the River Derwent pollution case. The plaintiffs, the Pride of Derby and Derbyshire Angling Association and the Earl of Harrington, sought injunctions and damages against British Celanese, Ltd., Derby Corporation and the British Electricity Authority for the alleged pollution of the River Derwent at Derby—in the case of the B.E.A. by discharging heated water into it—to the detriment of fish in the river.

Mr. Justice Harman said that the B.E.A. relied on certain statutory provisions, but the heating of the water was not the inevitable result of these. Power stations could be run on other lines and without returning cooling water to the river. His Lordship said that the nature of the relief to be granted to the plaintiffs would be discussed on 7th April.

B.E.A. Contracts

DURING the past month the British Electricity Authority has placed contracts for equipment for power stations, transforming stations and transmission lines, amounting to £2,070,393. They include:—Littlebrook "C" station, Dartford: One 60 MW turbo-generator set, feed heating and condensing plant.—C. A. Parsons & Co. Connah's Quay station, near Flint: Two 30 MW turbo-generator sets, feed heating and condensing plant.—C. A. Parsons & Co. Doncaster station: Two generator transformers.—General Electric Co. Fleetwood station: Bridge over railway.—M. J. Gleeson (Contractors), Ltd. Elstree substation: 275 kV. 7,500 MVA switchgear and 132 kV, 3,500 MVA switchgear.—A. Reyrolle & Co. Little Barford-Fulbourne 132 kV double circuit line.—B. I. Callender's Construction Co.

STOCKS and SHARES

SOME of the first company comments on the new excess profits levy appeared last week in the English Electric and Decca Record annual reports. Criticizing the Chancellor's adoption of earnings during the years 1947–8–9 as the standard above which the levy operates, Sir George Nelson, chairman of English Electric, says that defence demands accounted for practically none of the subsequent increase of business. For the raising of the company's turnover since 1946 by £24 million, and exports by 50 per cent, the credit is given to heavy capital expenditure on improving production and methods. Even with modifications, the levy passes, he maintains, the stationary business and strikes at the virile, progressive firm. It is stigmatized in the Decca Record report as having "a roulette-wheel incidence," and is shown to be particularly frustrating for a company which, like Decca, is just now revealing the results of work in its earlier developing years. Details of the levy in the Finance Bill brought no cheer to the industrial market in general, and little clarity regarding its effect in individual cases.

B. I. Callender's

Dealings started on Monday in the new shares of B. I. Callender's Cables which were offered at 22s to the shareholders, in the proportion of one new share for three old ones. The first call of 10s is due on 10th April, the final of 12s on 23rd May. The new shares do not rank for the final dividend for 1951. The directors have stated that preliminary figures indicate that profits for 1951 will show an improvement on the corresponding figure for 1950, and will be sufficient to maintain a dividend of 7½ per cent. The old shares are quoted at 25s ex rights, at which, on the 7½ per cent dividend, the return would be 6 per cent. The new shares stand at 2s 9d premium. In the Stock Exchange market, the shares are still known by the old name of "Wires."

British Oxygen Results

In declaring a final dividend of 12 per cent, which makes a total of 20 per cent for the sixth time running, British Oxygen publish a preliminary profits statement which may well be typical of many at this season. In brief, increased sales were accompanied by heavy advances in operating costs, which left, however, a material improvement in the trading profit; at the same time the net figure, after bigger charges for taxation and depreciation, comes out with little difference from the previous year's. At £1,146,000, it is £48,000 higher, and covers almost exactly twice the net amount distributed in preference and ordinary dividends. The ordinary shares advanced to 73s after the announcement to yield 5½ per cent, a return appropriate to an industrial equity in the "blue chip" class.

A. C. Cossor's Payment

In announcing the payment of two year's dividends on their half-a-million 6 per cent preference stock, A. C. Cossor are bringing matters up to date for the first time in three years. Nothing was distributed in 1949 or 1950, and a single year's payment of arrears was made last September. On the news, the shares concerned hardened to 19s 3d, the quotation including about 1s 3d net worth of dividend, so that the yield is some 6⅔ per cent. With this encumbrance removed, the 5s ordinary shares were firm at 11s. They have received no payment since the 25 per cent paid for 1946–47, although the emphatic recovery shown in the last two annual accounts began to bring dividends back into the picture; the last report, published in July, showed earnings equivalent to almost 150 per cent on the ordinary capital on the basis of deducting a single year's preference dividend. The financial year has just ended, and quickened interest in the shares is to be expected in anticipation of the results, which appeared last time in July.

General Electric "New"

Of General Electric's recent issue of 1·7 million new ordinary shares, some 90 per cent was accepted by stockholders exercising their "rights" and it was reported that the balance was covered many times over by applications for "excess" shares. Large applications for the latter were as a result scaled sharply down; but those for amounts of up to 150 shares received allotments in full. With the new shares worth at the time about half-a-crown more than the issue price of 72s 6d (and 78s now) allottees were presented with something well worth the having.

Price Changes

General Electric "old" shares are 3s 3d up at 77s. Moderate rises in Aron, Automatic Telephone, Lancashire Dynamo and Murex serve to balance declines in Telegraph Condenser, Walsall Conduits, Revo and Hoover. These movements are typical of the somewhat irregular state of the industrial market in general: business remains at a low ebb. Gilt-edged stocks have improved fractionally, the sterling–dollar exchange rate being the principle influence at present. Elsewhere a feature is the dullness of investment trust stocks; the companies appear to be liable to E.P.L. on their income from investments to which the levy will already have been applied once. Cable & Wireless ordinary fell 4 points to 107½; Globe Telegraph and Atlas Trust shed 3s and 9d respectively.

Electrical Investments

Past Week's Price Changes

Company	Dividend Pre-vious	Dividend Last	Middle Price Mar. 31 1952	Week's Rise or Fall	Est. Yield £	Est. Yield s	Est. Yield d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	82	+½	3	13	2
Brit. Elec. 1974/77	3	3	80½	+½	3	14	6
Brit. Elec. 1976/79	3½	3½	88	+½	3	8	2
Atlas Elec. ..	3	4	17/-	—9d	4	11	2
Calcutta Elec. ..	6†	6†	19/6	—	6	3	1†
East African Power	7	7	28/9	—	4	17	6
Nigerian Elec. ..	10	10	25/9xd	—	7	15	4
Palestine Elec. "A"	5†	5†	14/6	—	6	18	0†
Perak Hydro-Elec.	Nil	Nil	12/6	—		—	
Equipment and Manufacturing							
Aberdare Cables(5/-)	20	20	12/6	+1/-	8	0	0
Aerialite (1/-) ..	83½	88½	8/3	—6d	10	14	0
Aron Elec. Ord. ..	15	15	35/-	+ 1/6	8	11	6
Assoc. Elec. Ord.	20	20	66/6	—	6	0	3
Automatic Tel.& El.	12½	15	55/-	+ 1/6	5	9	0
Babcock & Wilcox	15	18	64/-	+6d	5	12	6
Baldwin, H. J. (2/-)	25	25	4/9	—3d	10	10	6
British Aluminium	10	10	34/9	+1/-	5	15	1
B.I. Callender's ..	6⅔	7½	25/-	—	6	0	0
British Thermostat (5/-)	30	30	27/-	+1/-	5	11	1
British Vac.Cleaner (5/-)	20	25	13/6	—	9	5	2
Brook Motors ..	20	20	32/6	—	6	3	1
Brush Ord. (5/-) ..	10	10	5/3	—	9	10	6
Burco (5/-) ..	42½	38⅔	20/-	—	9	13	9
Chloride El.Storage	12½	15	55/-	—	5	9	1
Cole, E. K. (5/-) ..	20	25	14/9xd	—	6	15	6°
Cossor, A. C. (5/-)	Nil	Nil	11/-	—		—	
Crabtree (10/-) ..	17½	17½	31/3	— 1/6	5	12	0
Crompton Parkinson Ord. (5/-) ..	11¼	11¼	8/9	—	6	8	9
De La Rue (5/-) ..	50	50	29/6	—6d	8	9	6
Decca (1/-) ..	112½	112½	16/-	—	7	0	9
E.M.I. (10/-) ..	8	12	11/9	—3d	8	2	8
Electrical Components (5/-) ..	20	20	11/3	—	8	17	10
Elec. Construction	15	15	47/6	—	6	6	3
Enfield Cable Ord.	7½	7½	25/-	—	6	0	0
English Electric ..	15	15	52/6	—	5	14	3
Ericsson Tel. (5/-)	22†	22†°	35/6	—	3	2	0†
Ever Ready (5/-)	35	35	23/6	—1/-	7	9	0
Falk Stadelmann	15	15	38/9	—	7	14	9
G.E.C. Ord. ..	17½	22½	77/-	+3/3	5	16	10
General Cables (5/-)	38	30*	17/6	—	8	11	6
Greenwood & Batley	15	15	41/3	— 1/6	7	5	0
Hackbridge Cable (5/-)	20	20	10/3	—	9	15	0
HackbridgeHewittic (5/-)	15	18	13/9	—	6	11	0
Hall Tel. Acc. (10/-)	10	10	11/6	—	8	13	10
Heatrae (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (5/-) ..	20	20	17/6	+6d	5	14	3
Hoover (5/-) ..	37½	35*	24/9	—1/-	7	1	5
Intl. Combustion (5/-)	20	25	20/3	+3d	6	3	5
Johnson & Phillips	15	15	46/3	— 1/6	6	9	9
Equipment and Manufacturing (continued)							
Lancashire Dynamo	22½	22½	40/6	+1/-	5	11	1
Laurence, Scott(5/-)	12½	12½	10/6	—	5	19	0
London Elec. Wire	10	10	37/6	—	5	6	8
J. Lucas	17½	7½°	30/9	—	4	17	5
Mather & Platt ..	12½	12½	41/3	+1/9	6	1	1
Metal Industries ..	10	10	35/-	—	5	11	3
Mid. Elec. Mfg. ..	15	15	53/9	—	5	11	6
Murex	10	12½	14/6	+2/-	5	12	4
Newman Ind. (2/-)	10	6	2/9	—		—	
Oldham & Son (1/-)	30	30	4/3	—	7	1	3
Parsons, C. A. ..	15	15	16/3	—	3	4	8°
Plessey (5/-) ..	20	22½	16/3	—	6	18	6
Pye Deferred (5/-)	35	18°	15/6	—6d	5	16	2
Revo (10/-) ..	27½	27½	31/3	— 1/6	8	16	0
Reyrolle	15	15	40/-	—9d	3	15	0°
Scot. Cable (4/-) ..	30	30	19/3	—	6	4	8
Siemens Ord. ..	7½	10	32/-	—	6	5	0
Switchgear & Cowans (5/-)	22½	22½	13/-	—	8	13	3
T.C.C. (10/-) ..	15	20	15/-	—1/-	4	9	0
T.C. & M. ..	10	10	33/9xd		5	18	6
TelephoneMfg.(5/-)	10	10	7/3	—	6	18	0
Thorn Elec. (5/-). .	20	10°	7/9	—	6	9	0
Tube Investments	25	25	5	+1/6	5	0	0
Vactric (5/-) ..	Nil	Nil	7/-	—		Nil	
Veritys (5/-) ..	2½	Nil	3/6	—		Nil	
Walsall Conduits (4/-)	70	70	47/-	—1/-	5	19	2
Ward & Goldstone (5/-)	44	45°	36/3	—	6	0	0
Watford (2/-) ..	20	25	5/9	—	8	14	0
Westinghouse Brake	14	14	41/6	—	6	6	2
West, Allen (5/-)	10	12½	9/9	—	6	8	2
Transport and Communications							
Anglo-Am. Tel.: A Ord.	—	—	84½	—			
Ord.	—	—	58	—			
Anglo-Portuguese	8	8	21/3	—	7	10	7
Brit. Elec. Traction: Def. Ord. ..	22½	25	315	—	7	1	9
Cable & Wireless: Ord.	6	8	107½	—4	7	8	9
4% Loan ..	4	4	95	—	4	1	3
Calcutta Trams ..	6†	6†	22/6xd	—	5	6	8°
Cape Elec. Trams	4	5	12/6	—1/6	8	0	0
Globe Tel. & Tel. Ord.	—	—	22/-	—3/-		—	
Inter. Tel. & Tel.	Nil	15cts	33	+1		—	
Marconi Marine ..	7½	16	27/6	+ 1/8	7	5	6
Oriental Tel. Ord.	16	16	46/3	—		—	
Telephone Props.	7	8	28/9	—	5	11	1
Tele. Rentals (5/-)	10	10	7/3	—	6	18	0

* After capital bonus.
† Dividends are paid free of Income Tax.

Lighting Fittings Makers

Speeches at Annual Luncheon

AT the annual luncheon of the Electric Light Fittings Association at the Piccadilly Hotel, London, on 26th March the president, Mr. K. Scott Adie, was in the chair and the principal guest was Sir Ronald Matthews, D.L., J.P., who proposed the toast of the Association.

In the course of his speech Sir Ronald Matthews said that modern trade associations eliminated competition by price and substituted competition by quality, to the consumer's benefit. If a firm wished to survive and expand it had to maintain quality and endeavour to excel its competitors.

The public had little idea of the skill, ingenuity and research which had gone into the lighting industry; they should be made more aware of their debt to the Association. As a maker of alloy steels, he could not say that members' material troubles were yet over. To-day the accent was on productivity and in this connection proper lighting was essential.

In his response to the toast, Mr. Scott Adie expressed his views on minimum price limitation. He considered that in the case of such products as those of E.L.F.A. members price control could be of vital importance and greatly to the advantage of the final purchaser. Decorative lighting fittings could not be the subject of standardization of price and design, but as regarded the fittings covered by the Association's price schedules control of efficiency could only be attained by a properly co-ordinated system of this kind.

The essentials of a good lighting fitting were the greatest possible output from the light source; the highest possible permanent efficiency; and the highest possible degree of "eyeability." It was to attain these ideals that the price schedules had been established. Although there was close technical liaison between the members there was also the keenest commercial rivalry on the basis of quality and efficiency.

Under a system of price competition manufacturers would be forced to employ other than the best materials, the best finishing methods, etc. Such a system would enable the buyer to save a shilling at the expense of pounds in lost efficiency. In the preparation of their schedules they had taken every possible care to be one hundred per cent honest in their basis of classification.

Mr. F. W. Norris proposed the health of the guests and in doing so mentioned that the Association was formed in 1926. Then it was general for those engaged in the industry to regard one another with suspicion. A new spirit was created and the intense competition which tended to result in shoddy workmanship and uneconomic production had been abandoned. The Association's trading structure was fair and would bear any investigation; the technical side was particularly cultivated.

Mr. J. Harwood Fryer, who responded, agreed that the public had benefited greatly from the members' activities. He felt that whatever the economic climate might be

Mr. K. Scott Adie, president of E.L.F.A., with Sir Ronald Matthews, Mr. J. Harwood Fryer and Mr. T. M. Adie

they need not fear. The Association was broadly founded not merely on a system of price maintenance but on a basis of fair trading and mutual assistance.

The toast of " The Past Presidents " was proposed by Mr. W. C. Huston who made particular reference to Mr. J. N. Stephens, one of the founders and the first president of the Association. He said that although all their presidents had been busy men they had given much of their time to the Association's affairs. The original number of members was nine; now there were 47. Mr. Huston spoke of the Association's service to the country during the war when it put over to manufacturers the idea of efficient lighting to stimulate production.

Mr. A. E. Iliffe replied on behalf of the past-presidents. He made mention of three who had died since their period of office—Messrs. Priest, Dean and Harvey. He called for a continuance of the spirit which had animated the Association's leaders.

PRESIDENT'S REPORT

In his report on the past year Mr. Scott Adie said that the industry continued to advance although the rate of progress had been somewhat retarded by shortage of materials and by limitations on use. A large number of lighting fittings of good design and high efficiency could no longer be produced but this emphasized the need for members to keep abreast of every development and innovation.

At the end of the year there were 47 members. Membership of the four classes was as follows (some firms being in more than one class):—Decorative fittings 28; commercial fittings 32; industrial fittings 36; street lighting 17.

The decorative fittings section had been hit by the restraints upon new building and the renovation of old buildings, coupled with import restrictions and foreign competition in overseas markets. Substitutes for copper, brass and nickel had had to be found and this increased the difficulties in export business.

Members of the commercial fittings section had also been adversely affected by material shortage. This section had reaffirmed its policy to operate 25 per cent as the maximum basic trade discount for members' products and it was to operate the same trading code as the industrial fittings section in so far as it met distribution requirements.

The important part undertaken by members of the industrial fittings section in improving production had been impressed upon Government Departments and it was hoped that as a result much more steel would be forthcoming to enable the industry to meet its " priority " commitments more promptly and adequately.

Mr. Scott Adie stated that the Minister of Transport was understood to be considering suggestions that simpler and more suitable contract conditions should be established for street lighting. The street lighting section had collaborated with the steel and concrete column manufacturers and with the erection contractors.

Trade with Eire, Mr. Scott Adie said, was officially regarded as " export " business but consideration was being given there to the adoption of a co-ordinated trading policy on the lines of E.L.F.A.

Representatives of the Association had their first meeting with officials of the Electricity Boards last July when they gave assurances that they were willing to discuss any future street lighting points.

The report included references to the Association's relationships with Government Departments, the Electrical Fair Trading Council and other associations.

Training Mission

THE exceptional opportunities for training in Britain available for Latin-American engineering graduates will be emphasized by a British Engineering Training Mission which, under the auspices of the Federation of British Industries and with the support of the Government, will leave for Latin-America on 29th April. The mission will consist of Sir Arthur Fleming, C.B.E., chairman of the F.B.I. Overseas Scholarships Committee and director of research and education of Associated Electrical Industries, Ltd.; Mr. F. R. Livock, a member of the F.B.I. Overseas Scholarships Committee and manager of education and training of the General Electric Co., Ltd.; and Mr. W. V. Jenkins, who is responsible for administering the F.B.I. overseas scholarships scheme.

With the co-operation of British engineering concerns, supplemented by a grant from the Board of Trade, students from Latin-America and elsewhere may receive scholarships of a value approaching £1,000 each for a two-year course. Industry's total contribution to the scheme will be some £20,000 a year and the Board of Trade will make a maximum grant of £10,000 for each of the first five years.

The object of the mission to Latin-America will be to make more widely known the training facilities available. The following are the countries to be visited: Mexico, Cuba, Venezuela, Colombia, Peru, Chile, Argentina, Uruguay and Brazil. The scholarships cover all branches of electrical, mechanical and civil engineering as well as metallurgy, and are available to graduates from countries in the British Commonwealth and Empire, the Near East, Far East and Africa, as well as Latin-America. The first scholars under the scheme are already receiving training. They come from Pakistan, Iran, the Sudan and Chile.

Electrical Engineers' Exhibition

Varied Display of Equipment

ABOUT seventy electrical manufacturers, as well as various associations, participated in a two-day exhibition held last week by the Central Regional Council of the Association of Supervising Electrical Engineers at the Royal Horticultural Society's New Hall, Westminster. The displays covered a very wide field from the aspects both of installation and utilization of electricity in industry, commerce and the home.

Especial emphasis was placed on research by both the British Electricity Authority and the Electrical Research Association. The latter organization, whose director, Dr. S. Whitehead, opened the exhibition, included among its display a working model of a heat pump, a recurrent surge oscillograph, a hydrogen-thyratron surge generator and a direct reading dielectric dispersion meter for testing the insulation of bushings, transformers, cables, etc., for the presence of moisture. Attention was drawn by the Electrical Development Association to the many services it places at the disposal of the electricity supply industry.

Cables and Accessories

The cable and accessory manufacturing side of the industry was especially well represented. High voltage cables of both oil-filled and gas cushion types up to 132 kV, solid type 33 kV cables, and typical cables for mining, transport, ships and industrial requirements, as well as various types of flexible cords, radio wires, etc., were shown by W. T. Henley's Telegraph Works Co., Ltd. Other of this company's products on view were a consumers' control unit, earth-leakage circuit breakers, slow break switches, h.r.c. cartridge fuses and "Solon" soldering irons. The Telegraph Construction & Maintenance Co., Ltd., showed paper insulated cables for power transmission and distribution up to 22 kV, including aluminium sheathed cables; polythene insulated power cables for 11 kV; and thermoplastic cables utilizing polythene and p.v.c. for general and special purposes.

With a display of aluminium sheathed rubber insulated cables, mass impregnated non-draining cables, extensible t.r.s. flexible cords, a claw type cable cleating system, an all-insulated industrial wiring system and resilient mounted connector units, British Insulated Callender's Cables, Ltd., had a striking exhibit demonstrating the application of power factor correction in a model factory.

Jointing Demonstration

A practical demonstration of cable jointing at 132 kV was given by Enfield Cables, Ltd., a specimen installation of grid suspension being rigged above the jointers' "hut" by means of cables and connection boxes. W. T. Glover & Co.'s exhibit ranged from flexible cords to h.v. paper insulated power cables, while accompanying the Standard Telephones & Cables display of power, communication, rubber and plastic cables were examples of "SenTer-Cel" selenium metal rectifiers. Besides its standard mineral insulated cables Pyrotenax, Ltd., showed h.f. and heating cables and thermocouples.

The General Electric Company's underfloor metal duct system provides a flexible method of distributing all electrical services in modern buildings. With it could be seen a selection of conduit fittings, wires, cables, distribution systems and installation accessories.

New designs of accessories providing for the incorporation of all types of switches, sockets, etc., in a standard box to B.S.I. requirements were shown by Walsall Conduits, Ltd., which also demonstrated an underfloor duct system, cable trunking, flameproof equipment, splayed base fittings (particularly suitable for hospitals) embodying "Sparkless" switch and switched socket outlets, ironclad gear including weatherproof units, conduit and conduit fittings. Easy working, extreme lightnest and metal economy are features of conduis made by the Kopex process demonstrated by Uni-tubes, Ltd. Complete ranges of

accessories were shown by Dorman & Smith, Ltd., the Wandsworth Electrical Manufacturing Co., Ltd., and S. O. Bowker, Ltd. " Ediswan Clix " accessories included " Surrey " switches and switch sockets, " Flexipin " plugs, the " Clix " cooker control unit and footpress switches.

The application of " Zedlock " products manufactured by Mantel Metalworkers, Ltd., was typified by consumers' control units and industrial cable trunking. Attention paid to securing reliability and ease of maintenance of their switches, fuseboards, etc., was emphasized by Wm. Sanders & Co. (Wednesbury), Ltd. Falk, Stadelmann & Co.'s industrial accessories included switchgear up to 500 A, while among the Simplex Electric Co.'s display were " Monarch " and " Regent " switches and switchfuses, Lundberg switches and a flameproof switch socket and plug.

An oil circuit breaker unit was shown by G.M. Engineering (Ottery St. Mary), Ltd., complete with instruments for controlling the incoming supply and directly connected to a busbar chamber on which were mounted fused switches for the control of outgoing circuits. This company also had on view wall mounting fused switches and a length of overhead busbar equipment. The Varilectric display comprised a cubicle type switchboard and two switchfuses.

Industrial Processes

Applications of electricity to industrial processes provided the theme for many of the displays. On the heat treatment side, Barlow-Whitney, Ltd., exhibited a humidity test cabinet; box ovens; wax, plastic and compound tanks; a unit air heater; a muffle furnace; glue, lead and solder pots; industrial immersion heaters; soldering irons; and ladles. Heating tapes and sheeting, resistor cord and magnetic snap action thermostats were demonstrated by Electrothermal Engineering, Ltd.

E.M.I. Factories, Ltd., had an induction heater working in conjunction with a special jig for the selective hardening of dental burrs, while Hirst Electronic Development, Ltd., showed a precision resistance welding machine, also for dental and similar work, as well as an industrial model for all types of fine precision welding. The use of " Nelson " stud welding for electrical installation and maintenance work was a feature of the Crompton Parkinson exhibit.

The " Metaltector " equipment developed by Loma Electronic Equipment, Ltd., can be employed to detect automatically the presence of metal in a wide range of materials and some of the products which were safeguarded by it were included in the display. Another instance of the diverse uses of electricity was provided by Goodmans Industries, Ltd., whose vibration generators are employed for material fatigue analysis; moving of powders, etc., along ducts; in optical cell research experiments; and in hairspring torque testing.

Water Heating

The " Autolec " electrode steam raiser and an " Autolec " electrode water boiler made by G.W.B. Electric Furnaces, Ltd., represented the modern approach to the provision of steam and hot water, eliminating all need for a boiler house, flue and chimney, fuel storage space and fuel handling equipment: the subsequent dirt and waste associated with fuel-fired boilers is also obviated. A selection of " Sadia " storage water heaters included the underdraining-board and coal-electric types. Besides storage types Santon, Ltd., showed immersion heaters, boilers and rotary switches.

Fuel waste in hot water tanks is eliminated by the use of the insulation jackets which Hurseal, Ltd., showed, together with electric bed sheets, room thermometers, towel rails and radiators. The three stages in the installation of " Thermovent " built-in convection heaters were indicated by a display panel arranged by E. K. Cole, Ltd., who also showed alternative arrangements of " Thermotube " tubular heating units. Among domestic appliances exhibited by the Revo Electric Co., Ltd., were fires, cookers, fans and irons. Both industrial and domestic type floor polishers were demonstrated by the Truvox Engineering Co., Ltd., while " Creda " appliances included the " Comet " horizontal and EV.13 cookers, the " Dulec " water heater, a wash boiler and new flat back fires.

Motors and Control Gear

In a composite display by three members of the Lancashire Dynamo Holdings Group, Lancashire Dynamo & Crypto (Mfg.), Ltd., and the Nevelin Electric Co., Ltd., showed a Lancashire-Nevelin " Varionic " variable speed drive (typical of

equipment designed for outputs of from 1 h.p. to 1,000 h.p.), while British Electronic Products' main exhibit was a fully automatic, multi-motor drive equipment for a continuous processing line; other electronic equipment, fractional h.p. motors and "Epicyclic" geared motor units were also shown.

A totally enclosed motor running in granulated cork formed the centrepiece of a display of fractional h.p. industrial flameproof and loom motors manufactured by Newman Industries, Ltd. A "Varispeed" drive comprising a grid controlled rectifier and d.c. motor were demonstrated by the Electric Construction Co., Ltd., whose other exhibits comprised an electric exposure meter, a 12-phase rectifier bulb and transformer, a model of rotating flash switchgear and rectifier, and an instrument panel showing indicating instruments.

A single-phasing preventer was included among a display of automatic and manual control gear and instruments prepared by the Electrical Apparatus Co., Ltd. Small geared motors, commutators, slip rings, soldering irons, and armature-field and transformer coils were shown by Browning's Electric Co., Ltd., while one of the most interesting items on the Automatic Coil Winder & Electrical Equipment Co.'s stand was the Douglas multi-winder producing coils with a total width of 15in.

Brushes for all types of motors were among the Powell Duffryn Carbon Products' display of carbon contacts, sealing rings, welding rods, clutch rings, etc. Carbon brushes were also shown by the Synthetic Carbon & Engineering Co., Ltd., the centrepiece of whose stand was a slow motion demonstration model showing brushes held at radial, reaction and trailing positions on an eccentrically mounted collector, with the object of illustrating the action of various designs of clock-spring actuated brush holders. This company also showed flexible braids, contact fingers, controller spares and certain maintenance articles, such as fibre glass commutator cleaning brushes, bedding stones, plastic cable clips and "Elvo" contact oil.

Motor repairs and rewinds are undertaken both by A. & M. Electrical Services and the Industrial Electrical Co., Ltd.; the latter company making a rotary magnetic extractor. Commutator maintenance equipment is supplied by the Martindale Electric Co., Ltd., as well as flexible shaft tools, etchers, and industrial vacuum cleaners.

Temperature control and measuring equipment, in which Sunvic Controls, Ltd., specializes, included thermostats, energy regulators, vacuum relays, time delay switches, maximum demand regulators, high speed recorders and vacuum pumping equipment. The Londex range of automatic control apparatus comprised multiple contact, mercury switch and midget relays; photo-electric equipment; process timers; "Lectralevel" floatless liquid level equipment; the "Flow Guard" remote flow indicator; a pressure switch; and a winker beacon. Mercury relays and contactors, relays, mercury time switches, contact thermometers, automatic control panels and sensitive control devices were among the more interesting Engel & Gibbs exhibits.

In addition to time switches, process timers and timing apparatus Venner, Ltd., had on view a new radio buoy, and lightweight silver-cell accumulators were displayed by its associate, Venner Accumulators, Ltd. A battery of sealed Planté type cells was shown with a typical "Safetylyte" automatic emergency lighting cubicle on the Tudor Accumulator Co.'s stand.

Lighting Equipment

Among lighting equipment a representative range of Crompton fittings included a new vapour-proof fluorescent type with a rigid p.v.c. reflector and a 5ft totally-enclosed commercial fluorescent fitting with single-piece fluted opal plastic diffuser. The "Amhurst" range of fluorescent and tungsten fittings has been designed by Courtney Pope (Electrical), Ltd., especially for stores, schools, banks, etc.

The "Instant-Self-Start" fluorescent lighting circuit was featured strongly on the Philips Electrical stand. "Mazda" fluorescent fittings included single and twin-lamp models of the corrosion resisting fluorescent fitting constructed entirely of "Perspex"; reflector, watertight, bulkhead, and other tungsten lamp units were also prominent on the British Thomson-Houston Co.'s stand. Falk, Stadelmann & Co., Ltd., exhibited a full range of both fluorescent and tungsten industrial and commercial fittings, while the Simplex display covered floodlights and reflectors. With Ediswan "Industra" reflectors and lamps

were Ediswan Harcourt industrial lighting fittings and fluorescent fittings.

Besides industrial fittings the Revo Electric Co., Ltd., showed the latest " Silverblue " street lighting lantern for use with mercury vapour lamps and the new " Silvergold " lantern with a single-piece " Perspex " bowl for sodium vapour lamps. Cold cathode lighting was represented by both Ionlite, Ltd., and Pearce Signs, Ltd., the latter showing neon signs and transformers. Visitors inspecting the Holophane industrial, commercial and street lighting units were invited to visit the company's demonstration theatre opposite the exhibition hall.

In addition to " Sieray " fluorescent lighting fittings and equipment, a colour matching unit and " Sieflash " tubes, Siemens Electric Lamps & Supplies, Ltd., showed an automatic telephone exchange. Apart from telephone coin collectors, Hull Telephone Accessories, Ltd., made a feature of the G.K.N. microhardness tester and a hotel radio control unit. The " Emidicta " electronic dictation machine was demonstrated by E.M.I. Sales & Service, Ltd. The high power amplifiers of W. Bryan Savage, Ltd., provide a source of power at variable frequency. Many types of fixed capacitors for electrical applications were exhibited by A. H. Hunt (Capacitors), Ltd.

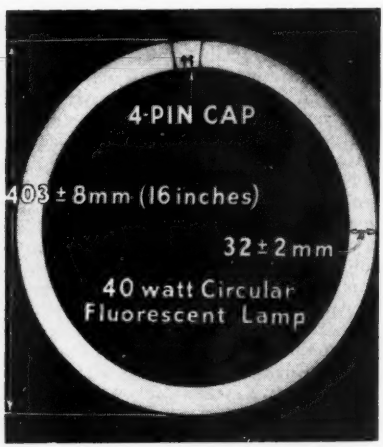
Last but not least the Electrical Industries Benevolent Association had an information bureau where details were given of its work and the great need which exists for increased support.

E.L.M.A. Developments

Smaller 60 W and New Circular Fluorescent Lamps

THE members of the Electric Lamp Manufacturers' Association propose to make 60 W general lighting service lamps (single-coil and coiled-coil) in the smaller size bulb used for the 40 W lamp. After consultation with the Electric Light Fittings Association, E.L.M.A. has approached the British Standards Institution with a view to making standard the 60 W lamp in the new size. Tests have proved that the present high standard of efficiency will not be affected.

The change, which it is proposed to make later this year, will increase efficiency of production and distribution, since the smaller dimensions mean economy in raw materials and in packing space.



New four-pin 40 W circular fluorescent lamp

E.L.M.A. members are to market a circular fluorescent lamp of a type which is claimed to be a complete innovation. The gap between the ends of the lamp is filled by a special four-pin cap, the circle thus being a completely closed one as is shown in the accompanying illustration.

The lamp is the result of laboratory research by E.L.M.A. members, its manufacture requiring new techniques, particularly in sealing and glass bending. It is rated at 40 W and the necessary auxiliary gear (switch start) is that already in use for straight 4ft 40 W lamps. A special holder for the four-pin cap has also been produced.

The available colour will be " mellow " and as the lamp will lend itself to fittings of a compact design it will be particularly valuable for the illumination of restaurants and public rooms in hotels and ships, for shops, theatres, banks and other public places where the decorative aspect is important. It should also help to popularize the use of fluorescent lighting in the home.

The new lamp will become available on 1st July and the list price will be 35s (plus purchase tax).

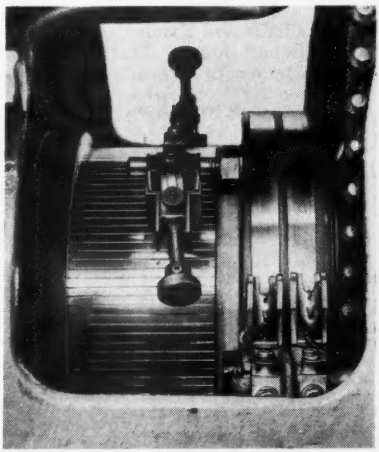
Variable-Frequency Generator

Constant Voltage Machine for Aircraft Industry

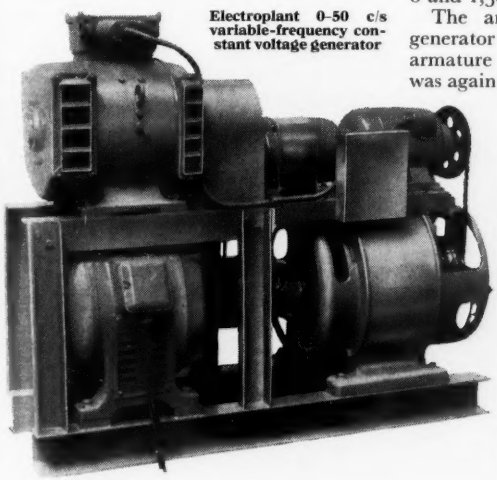
THE problem of providing a variable low-frequency source of energy at constant voltage was investigated some time ago by the Electroplant Co. (G.P.U., Ltd.), Palace of Engineering, Wembley, Middlesex. A potentiometer form of alternator was developed but this suffered from the disadvantage that it required a separate d.c. source considerably larger than the output from this arrangement, owing to the fact that the potentiometer current was heavy.

The company was considering the use of a d.c. generator with a commutator to provide the d.c. when it was approached by a leading aircraft manufacturer who required a low-frequency generator to operate a 2 kW vibrator from 0–50 c/s.

A normal d.c. machine was used and to preserve the existing windings these were converted to the triplex type as about 110 V was required. This machine was rotated by a normal capacitor start and run, single-phase, squirrel-cage motor. This motor also drove a 200 V busbar generator, the output of which, through regulators, served the main field of the d.c. generator and the field of a secondary d.c. generator, the latter being potentiometer controlled as part of a Ward-Leonard system for rotating brush gear at any speed between 0 and 1,500 r.p.m.



Close-up view of rotating brush gear



Electroplant 0–50 c/s variable-frequency constant voltage generator

The armature of this secondary d.c. generator was connected straight into the armature of a d.c. motor, the field of which was again supplied from the 200 V busbars. It will be readily understood that the speed of this driving motor armature was thus completely controlled by the secondary generator field potentiometer.

As the commutator on the main generator was of the axial type, brushes rotating round it had their pressure radially inwards due to the brush holder springs. However, when these brush holders were rotated, the centrifugal force set up tended to throw the brushes out radially against the springs and reduce the brush pressure against the commutator face. Therefore, a form of bell-crank lever was used,

one crank of which was threaded to take a balance weight. Thus, the faster this brush assembly was rotated, the more this balance weight tried to fly outwards, thereby increasing the pressure on the brush inwards radially and compensating for the outward radial thrust. This was found very satisfactory in practice, keeping a more or less constant pressure on the brush against the commutator throughout the whole speed range.

When we saw the arrangement which we have described demonstrated recently it worked very satisfactorily, the regulation being constant throughout the whole frequency range.

NEXT WEEK'S EVENTS

Monday, 7th April

BIRMINGHAM.—James Watt Memorial Institute 6.30 p.m. I.E.E. South Midland Education Discussion Circle. Discussion on "The Position of the Cathode Ray Oscillograph in Electrical Engineering," opened by Dr. W. Wilson.

Imperial Hotel, Temple Street, 6 p.m. I.E.E. South Midland Supply & Utilization Group. "A New Power Stroboscope for High-Speed Flash Photography," by W. D. Chesterman, D. R. Glegg, G. T. Peck and A. D. Meadowcroft.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North East London Branch. "Power Station Engineering," by H. D. Watson.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. Problems night.

LONDON.—Café Royal, W, 6.45 for 7.30 p.m. I.E.E. Supply & Utilization Sections. Joint dinner-dance.

Caxton Hall, S.W.1, 7 p.m. E.P.E.A. London Technical Group. "Advance in Lamps and Lighting," by L. J. Davis.

NEWCASTLE-ON-TYNE.—Royal Station Hotel, 6.15 p.m. I.E.E. North-Eastern Centre. Annual general meeting. 7 p.m. Conversazione.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. "Control of Machine Tools," by K. M. Swash.

SOUTHAMPTON.—Guildhall, 6.30 p.m. I.E.E. Southern Centre. Faraday Lecture on "Sound Recording—Home, Professional, Industrial and Scientific Applications," by Dr. G. F. Dutton.

Monday, 7th April, to Wednesday, 9th April

LONDON.—Grosvenor House, Park Lane. W.1. Radio and Electronic Component Manufacturers' Federation. Annual private exhibition.

LOUGHBOROUGH.—The College. I.E.E. East Midland Centre. Convention on Electrical Contacts.

Tuesday, 8th April

BELFAST.—Presbyterian Hostel, Howard Street, 6.45 p.m. I.E.E. Northern Ireland Centre. "Some Notes on Electrical Installations in Large Chemical Factories," by D. B. Hogg.

BOLTON.—Balmoral Hotel, Bradshawgate, 8 p.m. A.S.E.E. "Refrigeration," by Mr. Crowshaw.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, W.C.2, 5 p.m. Institution of Post Office Electrical Engineers. "A.C. Signalling—A Review of Current Problems," by B. R. Horsfield and D. C. Smith.

Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. "Photo-Luminescence as applied to Lighting," by H. W. Jenkins and A. H. McKeag.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Utilization Group. "Inherent Current, Voltage and Speed Control in Dynamo-Electric Machinery," by J. C. Macfarlane, Dr. J. W. Macfarlane and W. J. Macfarlane.

NEWPORT.—Tredegar Arms Hotel, 7 p.m. Newport & District Electric Club. "Electricity in Transport," by Dr. E. H. Norgrove.

Wednesday, 9th April

BLACKBURN.—N.W.E.B. Demonstration Theatre, Darwen Street, 7 p.m. I.E.E. North Lancashire Sub-Centre. "Economic Plant Sizes and Boiler Set Groupings on the British Grid," by B. Donkin and P. H. Margen.

BRADFORD.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. Film presented by L. Bruce.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. Scottish Centre. "The Design and Performance of Surge Divertors for the Protection of Alternating-Current Systems," by T. F. Monahan.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio Section. Symposium of papers on Microwave Links.

MERTON PARK.—A.S.E.E. South West London Branch, 8.15 p.m. Visit to film studios.

Thursday, 10th April

DUNDEE.—Royal Hotel, Union Street, 7 p.m. I.E.E. North-East Scotland Sub-Centre. Annual general meeting.

LIVERPOOL.—Merseyside & North Wales Electricity Board Showrooms, Whitechapel, 7 p.m. E.P.E.A. Merseyside Technical Group. "Some Notes on the Protection of Power Transformers," by H. T. Sheppard.

Supplies to Charitable Institutions

A recommendation was passed at the last meeting of the Midlands Electricity Consultative Council that the Midlands Electricity Board should consider a special tariff for supplies to institutions which are dependent entirely upon charity.

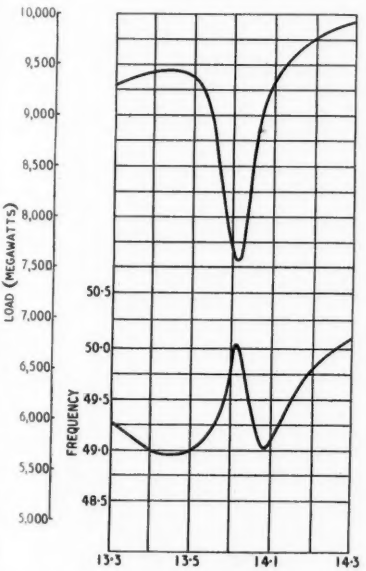
ELECTRICITY SUPPLY

System Control Tested

Higher Charges in London Area

A SEVERE test of the British Electricity Authority's system control was imposed by the two-minutes' silence observed during the funeral of the late King on 15th February. It will be seen from the curves which we reproduce that the national load fell suddenly from about 9,400 MW to 7,600 MW (about 19 per cent) and recovered as rapidly at the end of the silence to reach an even higher level. At the same time the frequency rose up to the two-minute period and quickly fell again after that period.

The probable effects were foreseen and plans were laid to cope with them. Some stations were instructed to decrease generation over a period of ten minutes or more before the silence; others were told to carry full load but to be prepared to reduce rapidly immediately before the silence; others ran at reduced load for a longer preceding period and were instructed to prepare for a sudden rise; while others were asked to make a definite reduction beforehand and pick up the same amount immediately after the silence.



National load and frequency curves for the afternoon of 15th February

All this involved special arrangements for the operation of steam plant, as well as "import" and "export" programmes following the fall and rise in local demand.

Aid was called for from the North of Scotland Hydro-Electric Board by which the inherent flexibility of water-power plant was used to control the power flow on the Meaford–Crewe and Peterborough–Bourne north-south interconnectors. But, necessarily, the bulk of the strain had to be taken by the steam stations.

By close co-operation between the system control engineers and the station operators the test was successfully borne. It is claimed that no boiler safety valves were lifted during the operations.

Supply to Estate

Exmouth Urban District Council heard last week that the South Western Electricity Board was prepared to supply electricity to Part 1 of the Salterton Road housing estate. Underground mains will be laid free of charge, providing the Council installs cooker and immersion heater circuits in the weekly rented houses and fully equips the monthly rented houses. The Council instructed the engineer and surveyor to include the necessary circuits in his specification for the houses and to accept the offer of the Electricity Board, subject to the approval of the Ministry of Housing and Local Government being obtained to the increased cost.

London Tariff Increases

Announcing increased charges in its Area, to operate after the meter readings following 19th April, the London Electricity Board explains that since tariffs were last adjusted the Board has had to meet increased working costs amounting to over £2,000,000 a year. Of this increase 54 per cent has been due to the rise in the cost of coal and 16 per cent to higher wages and salaries. The balance is largely required to pay the capital charges on development work and also to meet the increase in the bulk supply tariff already announced by the B.E.A.

The main alterations, which continue the

Board's policy of standardizing tariffs throughout the Area, are as follows:—Lighting flat rate raised to 5d/kWh and the flat rate for heating, cooking and small power to 1¾d/kWh in all districts where the existing rates are below these figures. Proportionate adjustments will be made in certain block tariffs. The fixed charges of many business and domestic two-part tariffs will be increased and standardized and the running charge under both domestic and business two-part tariffs will be increased from ¾d to 1d. Charges for many industrial supplies will be increased.

The changes will affect approximately 1,500,000 consumers in London and are estimated to produce £1,700,000 in the coming financial year.

Industrial Tariff Concession

Recently representations were made by the Leicester and County Chamber of Commerce regarding the implementation of the new industrial tariffs of the East Midlands Electricity Board. At last week's meeting of the Consultative Council at Nottingham it was reported that the Board was prepared to make a concession to industrial consumers supplied directly from the h.v. mains. From the date of the introduction of the new industrial tariffs, these consumers (to whom Tariff "A" applied) would be given an undertaking that their charges would not exceed those that would be payable on Tariff "C," provided that they entered into an agreement with the Board ensuring that the power factor of the supply was maintained at not less than 0·85 lagging and reserving to the Board the right to feed out of the consumer's substation into the local mains network. The minimum monthly charges under Tariff "A" would still apply.

Switch-House Accident

Two men were taken to hospital with burns to face and arms following an explosion and fire in the switch-house at Prince Rock power station, Plymouth. Electricity supplies throughout the Plymouth district were interrupted for about half an hour.

S.E. Consultative Council

Among the matters discussed at last week's meeting of the South Eastern Electricity Consultative Council in London was the observance of advertisement lighting restrictions during the winter. It was decided to draw the attention of the Minister of Fuel and Power to the rather unsatisfactory arrangements for enforcing the Order which tended to operate unfairly against conscientious consumers.

On the question of the application of the new standard three-part tariff to the Wingham pumping station, it was explained to Margate Corporation's representatives that the service charge component was designed to recoup the Board's fixed annual costs, and although the apparatus at Wingham was not new the Board had still to provide for its depreciation. In a letter from the Corporation it was indicated that the British Waterworks Association was being asked to consider the broad aspects of supplies to water undertakings.

A copy of a resolution was received from Hastings Corporation protesting against the latest increases in gas and electricity charges and suggesting that the law should be amended to require an official inquiry before such increases are made.

Asked by the Council to give individual notices to consumers of impending tariff changes, the Board has agreed that notices should be handed to consumers by meter readers.

Croydon Chamber of Commerce recently expressed the view that economy could be achieved by the joint reading of gas and electricity meters and on this point it was reported that the Electricity Board was approaching the Gas Board with a view to experiments being carried out in appropriate cases.

Transfer of Lines

The Minister of Fuel and Power has made the Electricity (Transmission Lines, England and Wales) (Transfer) Order, 1952 (S.I. 1952 No. 595), H.M. Stationery Office, price 6d. This transfers certain lower-voltage transmission lines from the British Electricity Authority to the Electricity Boards in whose areas they lie. Certain other lines vested in the London, Southern, Midlands, and Merseyside and North Wales Boards are transferred to the B.E.A. Another Order, the Electricity (Transmission Lines, Scotland) (Transfer) Order (S.I. 1952 No. 596), price 4d, transfers certain lower-voltage lines in Scotland from the B.E.A. to the two Scottish Electricity Boards.

Dispute Over Supply to Houses

Deputations from Falkirk Town Council and the S.E. Scotland Electricity Board were heard by the S.E. Scotland Electricity Consultative Council in Edinburgh last week regarding a dispute over the cost of providing electricity to the Town Council's Langlees estate. The Consultative Council decided to recommend that the Board should charge at the basic rate of £10 for each of 36 underground service connections to the 72 houses on the site, amounting to £360.

The Town Council wished to be charged at the rate of 10s per yard of underground cable formerly charged in the Falkirk area, which would amount to £307 10s. It was stated that the Board had made various offers which had been refused and it now felt obliged to enforce the statutory charges, probably amounting to £636. Originally, the Board proposed to connect the supply by overhead services, but the Town Council objected and after an official inquiry, the Minister of Fuel refused consent.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 14th May from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

9900. Philips Lamps, Ltd.—Electric arc-welding with coated welding rods. 14th April, 1947. (671915.)

1948

5941. Director of the Office of Technical Services, Department of Commerce.—Radio location systems. 27th February, 1948. (672112.) 5942. Electrical systems. 27th February, 1948. (672113.)

12241. British Thomson-Houston Co., Ltd., Clough, F. H., and Stretton, A. T.—Cap-like flyers for spinning machines. 4th May, 1949. (671923.)

18309. Oldham & Son, Ltd., and Booth, F.—Separators for electric accumulator plates. 10th June, 1949. (Cognate application 21484, 13th August, 1948.) (672122.)

19329. Denton Ingham, H. W. (Lumalampan Aktiebolag).—Method for applying a layer of colouring matter for luminous powder on the inside of lamp bulbs. 19th July, 1948. (671924.)

19708. Standard Telephones & Cables, Ltd.—Ultra-high-frequency electron discharge tubes. 23rd July, 1948. (671817.)

23390. Pye, Ltd., Cope, J. E., and Holland, E. O.—Apparatus for generating television and like waveforms. 31st August, 1949. (672125.)

25952. Flader, Inc., F.—Aircraft antenna system. 5th October, 1948. (672127.)

1949

3007. British Thomson-Houston Co., Ltd.—Punched magnetic core laminations for electric-induction apparatus such as transformers. 3rd February, 1949. (671823.)

5715. Philips Electrical, Ltd.—Methods of manufacturing luminescent screens. 2nd March, 1949. (671825.)

6276. Telephone Manufacturing Co., Ltd.—Electric generators. 22nd February, 1950. (672140.)

8189. Igranic Electric Co., Ltd.—Electric arc welding systems. 25th March, 1949. (672141.)

9621. General Electric Co., Ltd., and Rudge, T. R.—Electrical indicating instruments. 5th April, 1950. (672145.)

10171. British Tabulating Machine Co., Ltd., and Keen, H. H.—Circuit connecting devices for electrical apparatus. 5th April, 1950. (672146.)

11311. Compagnie Industrielle des Téléphones.—Inter-exchange system. 28th April, 1949. (672149.)

12885. Krizik, Narodni Podnik.—Circuit arrangement for regulating a synchronous electrical machine. 13th May, 1949. (671945.)

14586. Willheim, R.—Magnetic amplifiers. 30th March, 1950. (671836.)

15456. Electric & Musical Industries, Ltd.—Arrangements for measuring voltage and/or current. 12th June, 1950. (671951.)

15543. Communications Patents, Ltd.—Electronic valve amplifiers. 8th June, 1950. (672218.)

18385. Lacey, C. L.—Electric power supply and control apparatus. 12th July, 1950. (671954.)

19547. Fortiphone, Ltd., and Wolff, J.—Bone conduction telephone receivers. 29th June, 1950. (671957.)

24311. Every Ready Co. (Great Britain), Ltd., Measurement, Ltd., Receiver for Metropolitan Police District, Cawley, W. M. S., and Cowan, E. W. L.—Portable battery lamps. 24th November, 1950. (671847.)

26497. Trist & Co., Ltd., R., Chambers, W. A., and Clarke, A. G.—Use of photo-electric cells. 12th October, 1950. (671973.)

28496. Sandor, F. M. A. (legal representative of Sandor, N., deceased).—Electrical heating devices for rooms. 6th November, 1950. (671850.)

28881. Cinema-Television, Ltd., and Nuttal, T. C.—Apparatus for viewing and photographing a cathode-ray tube screen. 9th November, 1950. (671851.)

30047. British Thomson-Houston Co., Ltd.—Atomizing nozzles. 23rd November, 1949. (671853.)

30440. Brush Development Co.—Method of making an electromechanically responsive ceramic body. 28th November, 1949. (672226.)

30441. Brush Development Co.—Transducer device electromechanically sensitive to flexure. 28th November, 1949. (672227.)

30442. Brush Development Co.—Flexure-sensitive electromechanical transducer device. 28th November, 1949. (672228.)

32112. British Thomson-Houston Co., Ltd.—Methods of fabricating sealed glass envelopes. 14th December, 1949. (671854.)

33331. Standard Telephones & Cables, Ltd.—Broad-band amplifier using gas discharge plasma. 30th December, 1949. (671858.)

1950

77. Union Générale Belge d'Electricité Soc. Anon.—Method and installation for measuring the phase displacement of two a.c. voltages. 2nd January, 1950. (672015.)

199. Electric Furnace Co., Ltd., and Gardner, R. P. G.—Induction heating apparatus. 1st January, 1951. (672017.)

328. Londex, Ltd., and Besson, A. P.—Electric motors. 4th January, 1951. (672021.)

447. Submarine Cables, Ltd.—Electric cables. 3rd January, 1951. (672023.)

465. Automatic Telephone & Electric Co., Ltd.—Telephone systems. 1st January, 1951. (672024.)

1232. British Insulated Callender's Cables, Ltd.—Electric cables and other articles. 16th January, 1951. (672030.)

1305. Donovan Electrical Co., Ltd., and Fair, J. W.—Automatic starters for electric motors. 17th January, 1951. (672031.)

1656. National Research Development Corporation.—Aerial systems. 18th January, 1951. (672034.)

1696. English Electric Co., Ltd.—Drilling of holes. 12th January, 1951. (672036.)

2195. Magnesium Elektron, Ltd.—Anodes for cathodic protection of metal structures. 23rd January, 1951. (672042.)

2239. Haynes, H. F.—Television receivers. 23rd January, 1951. (672043.)

2334. Measurement, Ltd.—Electricity meters. 4th January, 1951. (672045.)

2405. General Electric Co., Ltd., and Mackenzie, R. B.—Thermionic valve relay circuits. 30th January, 1951. (672046.)

4520. Svit, Narodni Podnik.—Switching circuits for an inductive electric load. 22nd February, 1950. (672050.)

4974. Radio Corporation of America.—Light-sensitive element. 27th February, 1950. (672052.)

6234. Philips Electrical Industries, Ltd.—Magnetic recording devices. 13th March, 1950. (672057.)

6239. Philco Corporation.—Electrical pulse signal generator. 13th March, 1950. (672058.)

7024. British Thomson-Houston Co., Ltd.—Weighing and sorting apparatus. 21st March, 1950. (672061.)

9386. Aktiebolaget Svenska Flaktfabriken.—Electrostatic precipitators. 17th April, 1950. (672068.)

10526. Radio Corporation of America.—Television deflection power recovery circuits. 28th April, 1950. (672075.)

10560. Marconi's Wireless Telegraph, Co., Ltd.—Variable condensers. 7th December, 1950. (671983.)

11707. Metropolitan-Vickers Electrical Co., Ltd.—Welding or cutting apparatus. 10th May, 1950. (672081.)

11776. Igranic Electric Co., Ltd.—Electrical contact member and method of producing the same. 11th May, 1950. (672082.)

11790. Radio Corporation of America.—Scanning circuits for cathode-ray tubes. 11th May, 1950. (672083.)

11924. Hoover, Ltd.—Commutators for dynamo-electric machines. 12th May, 1950. (672085.)

12284. Philips Electrical Industries, Ltd.—Manufacture of grids for electric discharge tubes. 17th May, 1950. (672087.)

12973. Philips Electrical Industries, Ltd.—Diffraction cameras for X-ray examination of crystalline substances. 24th May, 1950. (672093.)

13660. Standard Telephones & Cables, Ltd.—A.c. measuring devices. 31st May, 1950. (672099.)

14118. Baker & Co., Inc.—Electrical resistance wire. 6th June, 1950. (672105.)

14786. Dow Chemical Co.—Sacrificial anode system for protecting metals in sea water. 13th June, 1950. (672110.)

14793. Scott & Williams, Inc.—Electric stop-motion for double feed mechanism on knitting-machines. 13th June, 1950. (672111.)

16418. Lacey, C. L.—Electric power supply apparatus. 12th July, 1950. (Divided out of 671954.) (671984.)

16420. Radio Corporation of America.—Wide band microwave spectroscopy. 30th June, 1950. (672156.)

17017. Singer Manufacturing Co.—Apparatus for seaming dielectric materials. 7th July, 1950. (672159.)

17684. Radio Corporation of America. Mounts for electron discharge devices. 14th July, 1950. (671875.)

18280. Westinghouse Electric International Co.—High-frequency apparatus incorporating means for coupling a source of power to a load. 21st July, 1950. (672166.)

18892. Standard Telephones & Cables, Ltd.—Electric wave amplifiers. 28th July, 1950. (672169.)

19379. Wallauschek, R.—Piezo-electric magnetometer. 3rd August, 1950. (671812.)

19417. Philips Electrical Industries, Ltd.—Luminescent materials. 3rd August, 1950. (672172.)

19743. Poor & Co.—Acid zinc electroplating compositions and method. 8th August, 1950. (672176.)

19779. Allmanna Svenska Elektriska Aktiebolag.—Electrically heated curtains or blinds. 9th August, 1950. (671881.)

19826. Bolle, E. A.—Arrangement for actuating an electric lamp switch in a telephone set. 9th August, 1950. (672177.)

21549. British Thomson-Houston Co., Ltd.—Load compensating networks. 31st August, 1950. (671901.)

21616. Philips Electrical Industries, Ltd.—Pulse code modulation communication systems. 1st September, 1950. (672184.)

21628. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Television pick-up tubes. 1st September, 1950. (671902.)

21847. Philips Electrical Industries, Ltd.—Circuit arrangements for producing direct voltages. 5th September, 1950. (672187.)

21959. British Thomson-Houston Co., Ltd.—Modulation systems. 6th September, 1950. (672188.)

22077. British Thomson-Houston Co., Ltd.—Electric valve converting circuits. 7th September, 1950. (671906.)

23142/3. Westinghouse Electric International Co.—Fans. 21st September, 1950. (672193/4.)

23167. Hydro-Nitro Soc. Anon.—Device for the generation of a high electric voltage. 21st September, 1950. (671913.)

23885. Western Electric Co., Inc.—Apparatus for compressing or expanding the amplitude range of electrical signalling waves. 29th September, 1950. (671989.)

24439. Philips Electrical Industries, Ltd.—Electric discharge tubes. 6th October, 1950. (671992.)

26986. Brooke, W., and Baldwin, H. T.—Three-phase electric switches or contactors. 4th November, 1950. (671999.)

27065. British Thomson-Houston Co., Ltd.—Magnetic cores for electromagnetic induction apparatus. 6th November, 1950. (672000.)

27229. Guimbal, J. M. C.—Hydraulic electric power-generating plants. 7th November, 1950. (672001.)

27745. Union Carbide & Carbon Corporation.—Commutators and the construction thereof. 14th November, 1950. (672002.)

27816. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Television pick-up tubes or the like. 14th November, 1950. (672205.)

28199. Lignes Télégraphiques et Téléphoniques.—Electrical conductors. 17th November, 1950. (672003.)

28548. Philips Electrical Industries, Ltd.—Electron-optical image convertor tubes. 22nd November, 1950. (672004.)

29199. Almanna Svenska Elektriska Aktiebolaget.—Arrangement for the control of a number of asynchronous induction motors. 29th November, 1950. (672207.)

30091. Western Electric Co., Inc.—Secondary electron emissive electrodes. 8th December, 1950. (672008.)

30374. Rheostatic Co., Ltd.—Electrical resistance units. 12th December, 1950. (672010.)

30435. Philips Electrical Industries, Ltd.—Rotary switches for use in automatic telephone systems. 13th December, 1950. (672011.)

1951

8811. Pye, Ltd., Cope, J. E., and Holland, E. O.—Waveform shaping circuit. 31st August, 1949. (Divided out of 672126.) (672195.)

NORWEGIAN IMPORTS

ELECTRICAL imports into Norway rose in value by 75 per cent last year, compared with 1950. Some of the leading items are given in the accompanying table, with notes of increases or decreases on the previous year. Much additional electrical material, not specified in the official returns, was also imported in increased volume. The principal suppliers were Great Britain, West Germany, Sweden, the United States, Holland and Denmark. (The Norwegian krone = about 1s.)

Class of Equipment	1951 Kr. (000)	Inc. or dec. on 1950 Kr. (000)
Electric motors	43,701	+ 13,371
Generators	9,212	— 6,911
Transformers	9,957	+ 1,001
Batteries and parts	6,005	+ 1,989
Accumulators and parts	4,823	+ 1,633
Incandescent lamps	7,393	+ 1,237
Radio valves	4,420	+ 2,109
Radio, telegraphic, etc., material	6,953	+ 3,065
Automatic telephone apparatus	5,970	— 927
Lead-covered cable up to 40 mm. diam.	8,343	+ 1,187
Ditto, 40 to 80 mm. diam.	6,325	— 205
Ditto, over 80 mm. diam.	147	— 177
Other electric wire	7,980	+ 4,153
Vacuum cleaners	827	— 494
Porcelain insulators, h.v.	4,255	+ 118
Porcelain insulators, l.v.	3,735	+ 1,425

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

When "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Bath. — Corporation. Electrical contractors wishing to tender for the electrical installation in the proposed new hall of residence at Bath Training College, Newton Park, should submit their names to the architects, A. J. Taylor & Partners, 4-5, Bridge Street, Bath, by 12th April. (See this issue.)

Pakistan.—KARACHI.—15th May. Director General of Supply and Development. Supply of electric motor driven or diesel engine driven pumping plants. (C.R.E. 10653/52. Ten/3742.)*

South Africa.—JOHANNESBURG.—1st May. G.P.O. Three radio telephony/telegraphy short-wave single-band transmitters. (C.R.E. 10737/52. Ten/3750.)* Supply of 2,500 time meters. (C.R.E. 10736/52. Ten/3756.)*

Tangier.—24th April. Electricity Department. International Zone. Fluorescent street lighting equipment. (C.R.E. 9900/52. Ten/3743.)*

Uruguay. — MONTEVIDEO. — Administracion General de las Usinas Electricas y Telefonos del Estado. 22nd April. Supply of 250 time meters for trunk line telephone conversations. (C.R.E. 8767/52. Ten/3749.)* Telephones with local battery, and accessories. (C.R.E. 8623/52. Ten/3748.)* 13th May. Equipment for the western circuit of the national network (Montevideo—Mercedes section). (C.R.E. 7276/52. Ten/3746.)*

ORDERS PLACED

London.—L.C.C.—Electrical installations at Broadwater County Primary and Gatton Day Special Schools.—C. S. Tagg, Ltd. Electrical installations at Campbell County Primary School, Paddington, and at New End School, Hampstead.—John Trapps (Electrical), Ltd.

POPLAR.—Borough Council. Electrical fittings and installations to 55 dwellings in the St. John's area (£1,957).—Holliday, Hall & Stinson, Ltd.

Middlesex.—County Council Education Committee. Recommended. Renewal of electrical installation in south wing of Down Lane School, Tottenham (£1,707).—Thorn & Hoddle, Ltd.

Newcastle-on-Tyne. — Regional Hospital Board. Internal mains for Garlands Hospital (£2,003).—British Insulated Callender's Cables, Ltd. Electric lighting installation, female ward No. 4, Garlands Hospital (£1,116).—Reid, Ferens & Co., Ltd.

Penrith. — U.D.C. Highways Committee. Recommended. Street lighting equipment, Scaws estate (£1,171). — North Western Electricity Board.

Stockport.—Corporation. Electrical installations in 98 houses and flats, Brinnington Neighbourhood Unit (£4,211).—Marlow Electrical Co., Ltd.

Stockton-on-Tees.—Town Council. Electrical installation in eight bungalows at Newham Grange, Stockton (£128).—Stewart & Son.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Basingstoke.—Houses (50), South Ham (£70,429); Reema Construction, Ltd., Milford Manor, Salisbury.

Carlisle. — Four-storey building at Albert Street and Swifts Lane for Cumberland and Westmorland T. & A.F. Association; Johnston & Wright, architects, 13, Castle Street.

Chelmsford.—Houses (33), Great Waltham; surveyor, Rural Council Offices, London Road.

Cheltenham.—Houses (42), for R.D.C.; Selleck Nicholls & Co., Ltd., builders, East Hill, St. Austell.

Chester.—Houses (110), Upton; surveyor, Rural Council Offices, White Friars.

Corby.—Hotel at Studfall Avenue and Tanfields Drive for P. Phipps & Co., Ltd., Northampton (£25,000); F. C. J. Smith, staff architect.

Darlington.—Houses (70) for the T.C. Builders: Boddy & Bell, Thomas Street, Darlington (12); Blackett & Son, Bondgate, Darlington (58).

Dartford.—Houses (122), in nine parishes; B. F. Kirby, surveyor, Council Offices, West Hill.

Dudley.—Home for aged at "The Woodlands" site; Harvey & Wicks, architects, 117, Hagley Road, Edgbaston, Birmingham.

Durham.—County infants' school at High Usworth (£44,000); Tarslag, Ltd., builders, Bowesfield Lane, Stockton.

Eastbourne.—Factory on site at Hampden Park; Microcell, Ltd., 45, Tabernacle Street, London, E.C.1.

Enfield.—Three-storey flats and shops, Nassau Cottages site, Hertford Road; Frank Lee, surveyor, 7, Little Park Gardens.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

Godalming.—Houses (40), Binscombe Farm estate; borough surveyor.

Gravesend. — Flats (69), Valley Drive; borough surveyor.

High Wycombe.—Chest clinic at War Memorial Hospital; Oxford Regional Hospital Board, 43, Banbury Road, Oxford.

Hyde.—Works extensions; Imperial Chemical Industries, Ltd., Leathercloth Division, Newton Road.

Leominster.—Houses (44), Westfield Walk; J. Brian Cooper, architect, 177, Corporation Street, Birmingham.

Lewes.—Houses (34), Church Lane estate; surveyor, Council Offices, Fisher Street, Lewes, East Sussex.

Leyland.—Houses (100), Wade Hall estate, for U.D.C.; A. Monk & Co., builders, Warrington.

Lindsey (Lincoln).—Schools at Coningsby, Gainsborough and Scunthorpe; county architect, County Offices, Newland, Lincoln.

Litherland.—Houses (82) and 18 bungalows at Netherton Park estate for U.D.C.; R. J. Barton & Sons, Ltd., 666a, Liverpool Road, Ainsdale.

Liverpool.—New office building at 7, Harrington Street, for T. J. Smith & Son, Ltd.; A. E. Shennan, architect, 17, North John Street, Liverpool.

London. — CITY. — Dwellings (312), Golden Lane, for City Corporation; G. Powell, architect, 16, The Little Boltons, S.W.10.

SHOREDITCH.—Drill hall and offices, Shaftesbury Street; Thomas & Edge, Ltd., builders, 25, Greens End, S.E.18.

Luton.—Offices, laboratory, workshops, canteen, etc.; D. Napier & Son, Ltd., Eaton Green Road.

Meriden.—Houses (50), Allesley, for R.D.C.; A. H. Gardner & Partners, architects, 11, Eaton Road, Coventry.

Middlesbrough.—Methodist Sunday School, Thorntree estate (£12,000); William Clark & Co., builders, Thornaby-on-Tees.

Newcastle-on-Tyne.—Flats (216), Slatyford Lane (Section F); city architect, 18, Cloth Market.

Houses (125), Kenton Lane, Montagu estate; city architect.

Northumberland.—Conversion of 650 acres into smallholdings, including the erection of ten farmstead units, cottages and other farm buildings at Heddon (£70,000); county architect, County Hall, Newcastle-on-Tyne.

Nottingham. — Church hall, Broxtowe; Gilbert & Hall, Ltd., Castle Boulevard.

Peterborough.—Factory extensions; E. M. Wilcox, Ltd., welders, etc., Acland Street.

Peterlee (Co. Durham).—Infants' school (£35,000); D. Glen, Ltd., builders, Albert Road, Jarrow.

Plymouth.—Five-storey building, Lockyer Street; secretary, Y.M.C.A., 14, Elliot Street.

Flats (24) and houses (161), Crownhill Road; city architect.

Portsmouth.—Flats (111), King's Road; Hawkins Bros., Ltd., builders, Westfield Road, Gosport.

Ruislip-Northwood.—Flats (84), Haydon Hall Drive, Eastcote; U.D.C. surveyor, Oaklands Gate, Northwood, Middx.

Silsden.—Flats (28) for U.D.C.; Gregory Flats, Ltd., Worthing.

Skipton.—Houses (12) and flats (16), Chapel Lane, Steeton, for R.D.C.; E. Turner & Sons, Ltd.

Southampton.—Flats (120), in three blocks, Itchen; borough surveyor, Civic Centre.

Spalding.—Old people's homes, Stonegate; architect and surveyor, Council Offices.

Stockport. — Houses (52), Thornley Lane estate; G. A. Lomas & Co., Ltd., Ungard Lane, Brinnington, Stockport.

Stockton-on-Tees. — Bus station, John Street; borough engineer.

Houses (248), north of Darlington Lane and east of Durham Road for the T.C.; borough architect, 28, The Square.

Stoke-on-Trent.—Additions to foundry at Longport for Billington & Newtown, Ltd.; Wood, Goldstraw & Yorath, architects, Cheapside, Hanley, Stoke-on-Trent.

Stretford.—R.C. secondary modern school at Firswood; H. Greengalgh, architect, 15, Mawdsley Street, Bolton.

Sunderland. — Houses (360), Farringdon. Builders: T. Stewart, The Westlands, Sunderland (50 houses); G. H. Pemper, Ltd., Old Chester Road, Sunderland (36); J. W. Ridley, Ltd., Sheepfolds, Sunderland (30); and L. W. Evans, Ltd., Norfolk Street, Sunderland (244).

Surbiton.—Houses (33), Chessington Hill Park estate; F. B. Ellmer, Ltd., 13, White Hart Lane, S.W.13.

Sutton Coldfield.—Houses (20), Falcon Lodge estate, site "Z"; Yenton Building Co. (1938), Ltd., 52, Graveley Hill North, Birmingham.

Swindon.—Dwellings (151), Penhill estate; borough engineer.

West Bromwich.—Factory, Bromford Lane industrial area; Midland Candle Co., Ltd., Heath Lane.

Offices and pattern stores; Highway Ironfounders (West Bromwich), Ltd., Phœnix Street.

Wigton.—Houses (26) in seven villages for the North-Eastern Housing Association, Curzon House, Maryport.

Workington.—Chest clinic at Workington Infirmary for the Regional Hospital Board (£9,000); J. Triname, Ltd., builders, Brigham, Cumberland.

Worsborough Dale (Yorks).—Extensions at Secondary School (£75,000); county architect, Wakefield.

Worthing.—Flats (34), Mardale Road site; borough surveyor, Town Hall.

Wortley.—Flats (20), St. Margarets Road, Ecclesfield, for R.D.C.; R. C. Brindley & Co., 50, The Walk, Birdwell.